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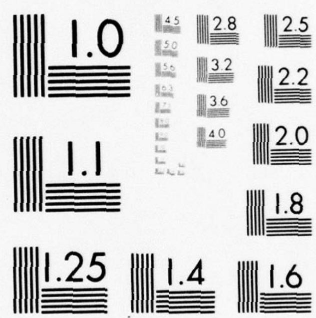

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AQUATIC DISPOSAL FIELD INVESTIGATIONS ASHTABULA RIVER DISPOSAL SITE, OHIO.

APPENDIX B: INVESTIGATION OF THE HYDRAULIC REGIME AND PHYSICAL NATURE OF BOTTOM SEDIMENTATION.

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by

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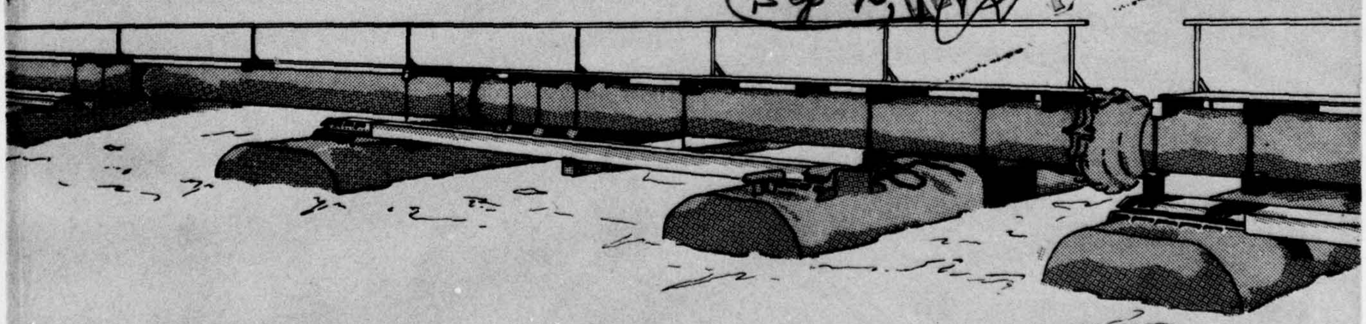

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AQUATIC DISPOSAL FIELD INVESTIGATIONS,
ASHTABULA RIVER DISPOSAL SITE,
OHIO

Appendix A: Planktonic Communities, Fishery, and Benthic Assemblages

Appendix B: Investigation of the Hydraulic Regime and Physical Nature of Bottom Sedimentation

Appendix C: Investigation of Water-Quality and Sediment Parameters

DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
P. O. BOX 631
VICKSBURG, MISSISSIPPI 39180

IN REPLY REFER TO: WESYV 31 December 1977

SUBJECT: Transmittal of Technical Report D-77-42 (Appendix B)

TO: All Report Recipients

1. The technical report transmitted herewith represents the results of one of several research efforts (work units) undertaken as part of Task 1A, Aquatic Disposal Field Investigations, of the Corps of Engineers' Dredged Material Research Program. Task 1A is a part of the Environmental Impacts and Criteria Development Project (EICDP), which has as a general objective determination of the magnitude and extent of effects of disposal sites on organisms and the quality of surrounding water, and the rate, diversity, and extent such sites are recolonized by benthic flora and fauna. The study reported herein was an integral part of a series of research contracts jointly developed to achieve the EICDP general objective at the Ashtabula, Ohio, site in Lake Erie, one of five sites located in several geographical regions of the United States. Consequently, this report presents results and interpretations of but one of several closely interrelated efforts and should be used only in conjunction with and consideration of other related reports for this site.

2. This report, Appendix B: Investigation of the Hydraulic Regime and Physical Nature of Bottom Sedimentation, is one of three contractor-prepared appendices published relative to Waterways Experiment Station Technical Report D-77-42 entitled Aquatic Disposal Field Investigations, Ashtabula River Disposal Site, Ohio. The titles of all contractor-prepared appendices of this series are listed on the inside front cover of this report. The main report will provide additional results, interpretations, and conclusions not found in the individual appendices and provide a comprehensive summary and synthesis overview of the entire project.

3. The purpose of this study, conducted as Work Unit 1A08B, was to identify the baseline hydraulic regime, the meteorology, and the physical nature of bottom sedimentation in the Ashtabula Disposal Site and the surrounding area. The report includes a discussion of the distribution of sediments and the distribution of currents that affect sediment erosion, transportation, and deposition within and in the vicinity of the site. The sediment distribution was determined through grab sampling,

subbottom profiling, and coring of the area. Circulation patterns were delineated with current meters and wave gages. Temperature profiles, suspended sediment sampling, and investigations of the interaction at the sediment-water interface were also made to obtain data needed to determine the movement of sediment within the site. Water levels of Lake Erie and flow rate and suspended sediment load of the Ashtabula River were determined.

4. A conclusion of this report, based on the data presented, was that the Ashtabula Disposal Site was an acceptable site for use as a dredged material repository where the dredged material disposal operation had little effect on the physical nature of the area. The localized increases in temperature, turbidity, and currents resulting from the descending material were transient and the conditions generally returned to normal within an hour.

5. The evaluations at all of the EICDP field sites were developed to determine the base or ambient physical, chemical, and biological conditions at the respective sites from which to determine impacts due to the subsequent disposal operations. Where the dump sites had historical usage, the long-term impacts of dumping at these sites could also be ascertained. The results of this study are important in determining placement of dredged material for open-water disposal. Referenced studies, as well as the ones summarized in this report, will aid in determining the optimum disposal conditions and site selection for either the dispersion of the material from the dump site or for its retention within the confines of the site, whichever is preferred for maximum environmental protection at a given site.

John L. Cannon

JOHN. L. CANNON
Colonel, Corps of Engineers
Commander and Director

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

An investigation of the hydraulic regime and physical nature of bottom sedimentation was conducted in Lake Erie near the Ashtabula Disposal Site. The field sampling phase of the program, conducted between June 1975 and September 1976, included detailed monitoring of physical parameters before, during, and after disposal operations at the disposal sites and at reference stations. The various hydraulic, sedimentologic, and limnologic data gathered from the site and analyzed include bathymetry and (Continued)

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20. ABSTRACT (Continued).

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subbottom profiles; current speed and direction, temperature, and transmissivity within the water column; wave characteristics; bottom sediment characteristics and distribution; water levels of Lake Erie; and flow rate and suspended sediment load of the Ashtabula River.

The study indicated that the dredged material disposal operation had little effect on the physical nature of the area. The localized increases in temperature, turbidity, and currents resulting from the descending material were quite transient and the conditions generally returned to ambient within an hour. The resulting sediment piles on the lake bottom were less than 0.5 m thick, and were subject to erosion from currents and waves. The currents were the main cause of erosion as most of the wave energy did not penetrate to the bottom. Most of the sediment erosion and subsequent transport occurred during storms when current speeds and wave heights were greatest. Since the currents were generally parallel to shore, the transport of the resuspended dredged material was probably shore-parallel and the material could have traveled several kilometers before settling out of the water column. Analysis of bottom sediment cores revealed that the dredged material was difficult to distinguish from the original lake bottom, indicating that the disposal operation produced only minimal changes in the physical nature of the sediments in the area.

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SUMMARY

An investigation of the hydraulic regime and physical nature of bottom sedimentation was conducted in Lake Erie near the Ashtabula Disposal Site. The field sampling phase of the program, conducted between June 1975 and September 1976, included detailed monitoring of physical parameters before, during, and after disposal operations at the disposal sites and at reference stations. Two disposal operations were monitored, one in August 1975 and the other in May 1976. The various hydraulic, sedimentologic, and limnologic data gathered from the site and analyzed include bathymetry and subbottom profiles; current speed and direction, temperature, and transmissivity within the water column; wave characteristics; bottom sediment characteristics and distribution; water levels of Lake Erie; and flow rate and suspended sediment load of the Ashtabula River.

Detailed bathymetric measurements taken before and after disposal operations at three disposal sites and large-scale bathymetric surveys of the entire study area conducted in July 1975 and in September 1976 showed that the study area was relatively smooth with a slope of about 1 m/km. The disposal area, however, was quite irregular as a result of earlier disposal activities. The detailed bathymetric measurements showed that less than 0.5 m of dredged material was deposited at the disposal sites. The thickness of the sediment pile could not be determined with the subbottom profiles because the original lake bottom could not be distinguished from the dredged material.

Continuous current-meter measurements were taken at depths of 1 and 3 m above the bottom during the entire study. The average speed measured at the 3-m level was 12 cm/sec and at the 1-m level, 5 cm/sec. The direction of flow at both levels was generally parallel to the shore. Spectral analysis

of the data revealed that the most prominent periodic component of the velocity field was the first longitudinal seiche mode of Lake Erie, which had a period of about 14 hr. There were also noticeable amounts of energy attributed to the lunar tide (12 hr) and inertial currents (18 hr). Vertical profiles of the currents taken during the monthly sampling periods showed that the speed was quite variable but generally decreased with depth. The average direction of flow, at times, was uniform over the whole study area.

Temperature measurements were made continuously with thermographs located at 1 and 3 m from the bottom. Vertical profiles of the temperature were also measured during the monthly sampling periods. The water temperature at the 3- and 1-m levels reached a maximum of about 22° C near the end of August 1975 and a minimum of nearly 0°C in January 1976. The surface temperatures occasionally exeeded 26°C. There was frequently a well-developed thermocline in July and August with temperature differences as great as 11°C across the interface.

Vertical profiles of transmissivity were taken concurrently with the temperature profiles. The transmissivity was usually greatest near the surface and decreased with depth. There was frequently a sharp decrease near the thermocline. The transmissivity was generally lower closer to the shore, but decreased to near zero values at all stations following severe storms.

Wave measurements were taken every 4 hr with a pressure sensitive wave gauge. The average wave period measured was about 5.5 sec. Most of the waves were less than 1 m, but during storms the wave height frequently reached 2 m. The majority of the waves' orbital velocities were less than 1 cm/sec near the bottom, but under storm conditions values increased to over 10 cm/sec. Visual wave observations were also made that revealed that the greatest percentage of waves

approached the shore from the northwest.

Meteorological data collected at the site included measurement of wind speed and direction, air temperature, and solar radiation. The predominant wind direction was from the south with a secondary flow from the west. The average wind speed was about 2.5 m/sec and the maximum hourly average speed was 13.4 m/sec, which occurred in November 1975. The maximum solar radiation (80.4 ly/hr) and air temperature (32.2°C) values both occurred in July 1975.

Water-level data for Lake Erie were used to standardize the bathymetry results. The water level fluctuated very little near the study site with the minimum value of 173.74 m occurring in November 1975 and the maximum of 174.90 m occurring in June 1976.* Ashtabula River discharge values were obtained from the United States Geological Survey (USGS) and showed that the greatest river discharges occurred during the winter months. The greatest discharge rate was 110 m^3/sec, which occurred in February 1976, whereas the rate dropped to nearly zero during the summer months. Total suspended sediment values were estimated from the river discharge values and were found to be so low that the river plume had virtually no effect on the transmissivity at the disposal site.

Sediment traps and survey rods were used to measure the amount of sediment deposited at the disposal sites. The measurements indicated that the amount of sediment that had collected at two different sites used for disposal in 1975 was 45 and 37 cm. Of the 45 cm of sediment that had collected at one of the sites, 15 cm were subsequently eroded in the 3 months following the disposal operation. Most of this erosion occurred during two storms in October and November 1975. The measurements at a third disposal site in 1976 showed that a 36-cm-high, cone-shaped pile had been deposited during the

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* *International Great Lakes Datum; water depth = 16.5 m.*

disposal operation. The volume of pile, however, accounted for less than 70 percent of the material that was reported discharged at the site. Erosion occurred in the months following the disposal operation as the readings on the survey rods generally decreased, and ripples and scour marks were observed by the diver. The amount of erosion following the 1976 disposal operation, however, was less than that observed following the 1975 disposal operation. Changes in the sediment-trap readings in most cases were negligible, which indicated that compaction of sediments was not prominent.

Sediment shear strength measurements were taken at several depths at all stations near the northwest disposal site. The sediment shear strengths generally increased with depth; however, there were frequent large variations with depth and there were also considerable variations between stations.

Radiographs and X-ray scans were made of several sediment cores. These showed the discontinuity between the old and new sediments. They also showed the graded bedding that resulted from the continuous discharging of the dredged material.

The sediment cores were analyzed for grain-size distribution, and linear discriminate function plots were developed from the grain-size data. The plots showed a definite separation between the predisposal and postdisposal sediments. The plots also illustrated that after 3 months, the surface sediment distribution at several stations had returned to its predisposal form. Multivariate analysis of variance showed that the observed changes were statistically significant.

Since the data indicated that there was sediment transport following the disposal operation, attempts were made to determine the direction of the transport. Results of a computer program (SEDMOT), based on the current meter data, indicated that the transport was generally parallel to shore and predominantly to the northeast. Cluster analysis, Folk's

moment statistics, and trend surfaces developed from the sediment core data were also used to estimate the distribution and transport of the disposed material. The results from these analyses, however, were inconclusive as the grain-size distribution of the dredged material could not be readily distinguished from that of the original lake bottom.

The measurements made during disposal operations approximately 70 m from the point of discharge indicated that a temporary 2°C temperature increase resulted from the discharged material falling to the bottom. Individual disposals also produced surges in the currents with speeds reaching 70 cm/sec. These currents, however, returned to normal within a few minutes. The sediment plume was tracked with a moving vessel by using the fathometer which recorded the suspended sediments. The measurements showed that the material settled quickly and the conditions returned to ambient within an hour.

The measurements taken in the disposal area and the subsequent analysis of the data indicate that the disposal of the dredged material had very little effect on the physical nature of the area. However, the significance of the physical factors in contributing to the total impacts of the disposal operations can be fully understood only when analyzed together with the associated chemical and biological factors.

PREFACE

This report presents the results of an investigation of the hydraulic regime and bottom sedimentation of Lake Erie near the Ashtabula Disposal Site, Ashtabula, Ohio. The study was supported by the U.S. Army Engineer Waterways Experiment Station (WES), Environmental Effects Laboratory (EEL), Vicksburg, Mississippi, under Contract No. DACW39-75-C-0108 with the Environmental Sciences Division of Industrial BIO-TEST Laboratories, Inc. (presently known as NALCO Environmental Sciences), Northbrook, Illinois. The report forms part of the EEL Dredged Material Research Program (DMRP).

The portion of the study reported herein was conducted during the period June 1975 through September 1976 by the Physical Sciences Section of NALCO Environmental Sciences under the supervision and coordination of Dr. Richard G. Johnson. The following personnel of the Physical Sciences Section were involved in the data collection, analysis, and report writing: Dr. L. J. Danek, Mr. G. R. Alther, Drs. P. P. Paily and R. G. Johnson, and Messrs. F. de Libero, J. F. Yohn, and F. T. Lovorn. Assistance in data processing was also rendered by Messrs. Z. Jao, W. Skibbe, and P. Skepnek, all of NALCO Environmental Sciences.

The study was conducted under the direction of the following EEL personnel: Dr. John Harrison, Chief, EEL; Dr. R. M. Engler, Project Manager; Dr. J. G. Seelye, Site Manager; Mr. S. P. Cobb, Site Coordinator; and Messrs. M. Granat and B. Holliday, Project Team Members.

The Directors of WES during the study and preparation of this report were COL G. H. Hilt, CE, and COL J. L. Cannon, CE. Technical Director was Mr. F. R. Brown.

CONTENTS

LIST OF FIGURES

CONVERSION FACTORS, U.S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

U.S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
inches	25.4	millimeters
feet	0.3048	meters
miles (U.S. statute)	1.609344	kilometers
square miles	2.589988	square kilometers
cubic feet per second	0.02831685	cubic meters per second
tons (2000 lb, mass)	907.1847	kilograms
pounds (force) per square inch	6894.757	pascals
ounce-inches	0.007061552	newton-meters
langleys	41,840	joules per square meter
degrees (angular)	0.01745329	radians

AQUATIC DISPOSAL FIELD INVESTIGATIONS

ASHTABULA RIVER DISPOSAL SITE, OHIO

APPENDIX B: INVESTIGATION OF THE HYDRAULIC REGIME AND PHYSICAL NATURE OF BOTTOM SEDIMENTATION

PART I: INTRODUCTION

Background

1. The U.S. Army Corps of Engineers (CE) was authorized in 1824 to remove sandbars and snags from major navigational waterways in the United States. Since that time, the Corps maintenance activities have continually increased as the need for navigable waterways has increased. At the present time, the Corps of Engineers maintains over 30,000 km of waterways and about 1000 harbors, and the amount of materials dredged from these channels annually amounts to approximately 230 million m^3 (Boyd et al. 1972). The continued increase in dredging activities, along with better understanding of nearshore environments, has produced increased concern about these practices. This concern has resulted in legislation aimed at regulating disposal of dredged material into natural open waters.

2. Research related to environmental effects of dredging has increased due to the Federal Water Pollution Control Administration Act of 1972, which requires permits for discharge into navigable waters, and the National Environmental Policy Act of 1969, which requires the preparation of environmental impact statements on activities such as dredging. Subsequent to this legislation, the Corps of Engineers has initiated comprehensive research programs on the environmental impact of dredging that are administered through the U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi.

3. The Dredged Material Research Program (DMRP) being conducted by the Environmental Effects Laboratory (EEL), WES, is an extensive interdisciplinary research effort to identify and determine the short- and long-term impacts associated with the disposal of dredged material and, in particular, the significance of physical, chemical, and biological factors that govern the rate, extent, and diversity by which open-water disposal sites are colonized by benthic communities. The investigations of the hydraulic regime and the physical nature of bottom sedimentation in Lake Erie were designed to be an integral part of the DMRP in relation to the aquatic disposal field investigations at the Ashtabula Disposal Site, Ashtabula, Ohio.

Purpose and Scope

4. The purpose of this investigation of the hydraulic regime and bottom sedimentation in Lake Erie was to obtain baseline data on a proposed dredged material disposal area in the lake offshore of Ashtabula Harbor, Ohio. The data were required to establish seasonal variability of measured parameters, establish a controlled disposal site, and establish a reference area* outside the disposal site. Measurements were also made to determine the extent of the sediment pile resulting from the disposed material and to monitor changes that occurred in the pile because of erosion or compaction.

5. The scope of the study included a literature search, and evaluation of information of various hydraulic, sedimentologic, and limnologic data gathered and documented from the site. These data included current speed and direction, and temperature throughout the water column; wave activity; transmissivity within the water column; bathymetry

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* The reference area is referred to as the control area in this report.

and subbottom profiles; bottom sediment characteristics and distribution; water level of Lake Erie; and flow rate and suspended sediment load of the Ashtabula River. Various meteorological parameters including wind speed and direction, incident solar radiation, air temperature, and precipitation were also documented.

6. In order to accomplish the study objectives, a concentrated field investigation was conducted in the dredged material disposal area. The study included detailed monitoring of physical parameters before, during, and after disposal operations at the disposal sites and at control stations. Figure B1 shows a location map of the disposal area. Locations D2 and D8 were the disposal sites for the August 1975 disposal operations. A second disposal operation was conducted in the northwest corner of the disposal area in May 1976. This site will be referred to as the new disposal site (ND). The locations of the control sites (C1 and C3) and the position of the meteorological station and the sites for sediment sampling are also shown in the location map (Figure B1).

7. Vertical profiles of temperature, transmissivity, and current velocity were taken monthly at selected locations. Figure B2 shows the locations of these stations (TC1 to TC6) relative to the disposal area. A permanent mooring was installed at station PC1 where continuous current and temperature data were recorded at two levels in the water column. A pressure sensor for measuring and recording wave height was also located near the mooring at station PC1.

8. A fine-scale array of stations centered on the new disposal site (Figure B3) was established to closely monitor the distribution of sediments resulting from the 1976 disposal operations. Sediment traps and survey rods were installed at 17 stations and were serviced monthly. This type of grid was necessary so that fish nets could still be pulled through the disposal area without disturbing the sediment

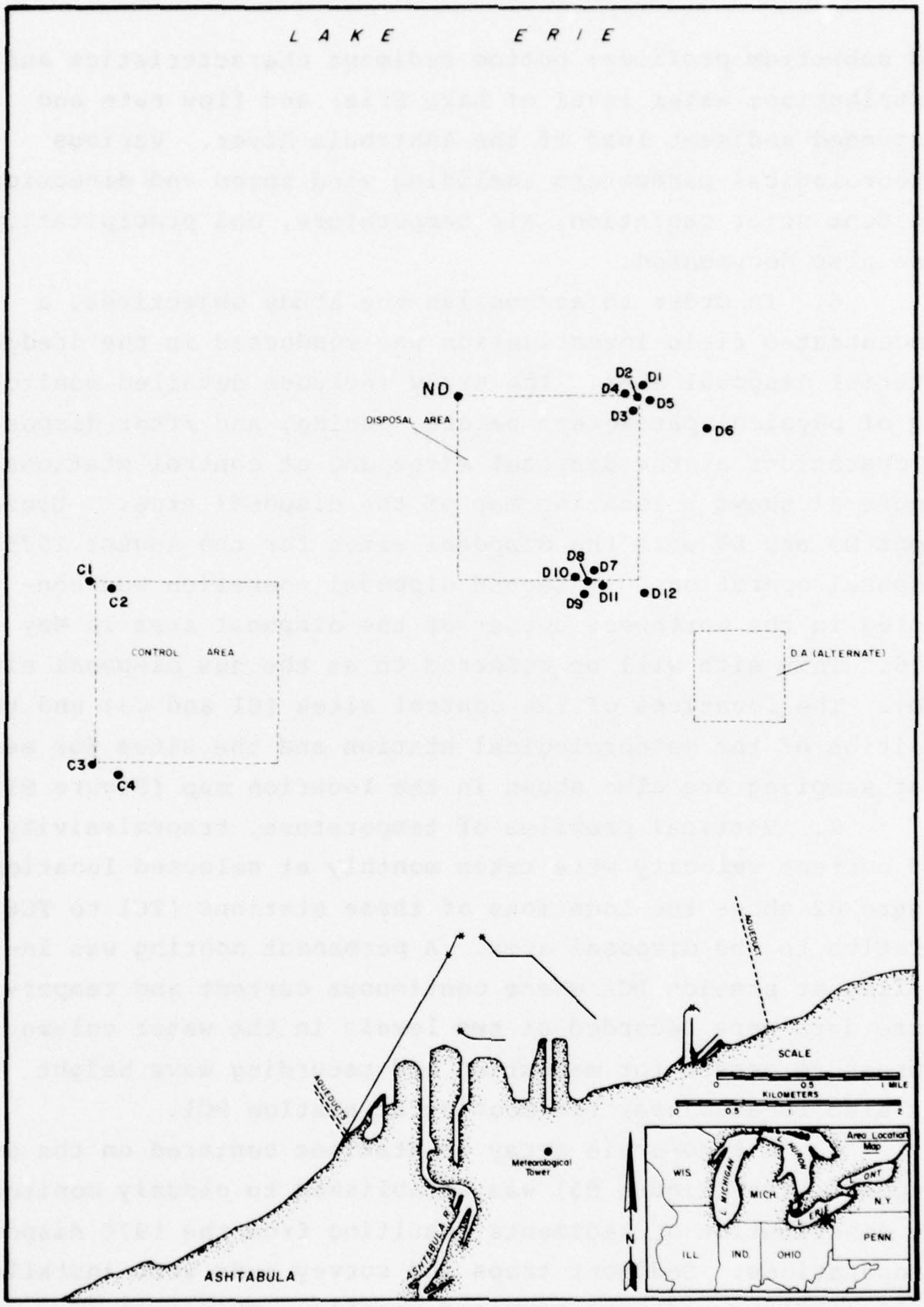

Figure B1. Location of sampling stations at the control and disposal sites

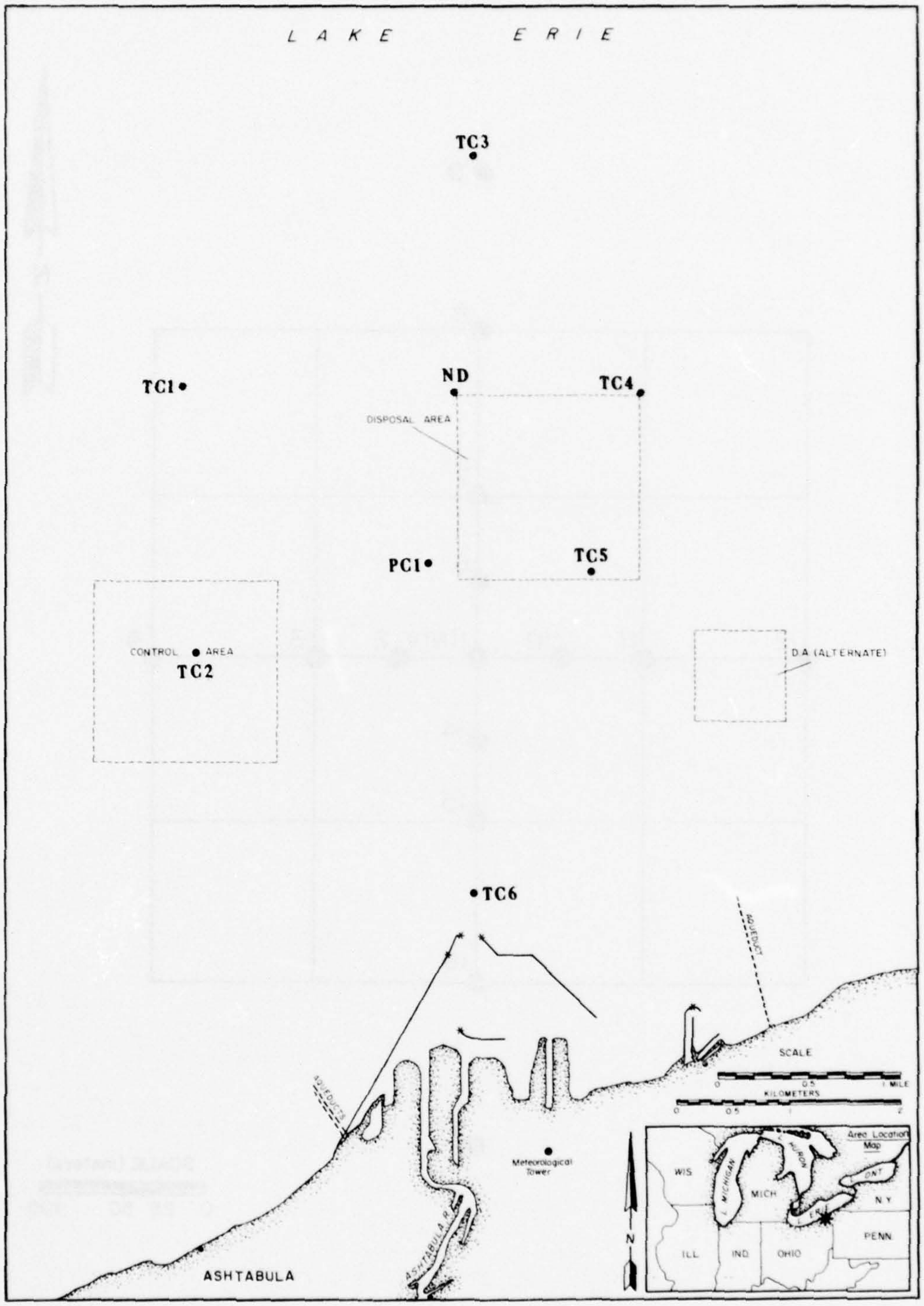

Figure B2. Location of permanent mooring for continuous current and temperature measurements (PC1) and locations for vertical profile measurements of temperature, transmissivity, and current (TC1 through TC6) relative to the location of the new disposal site (ND)

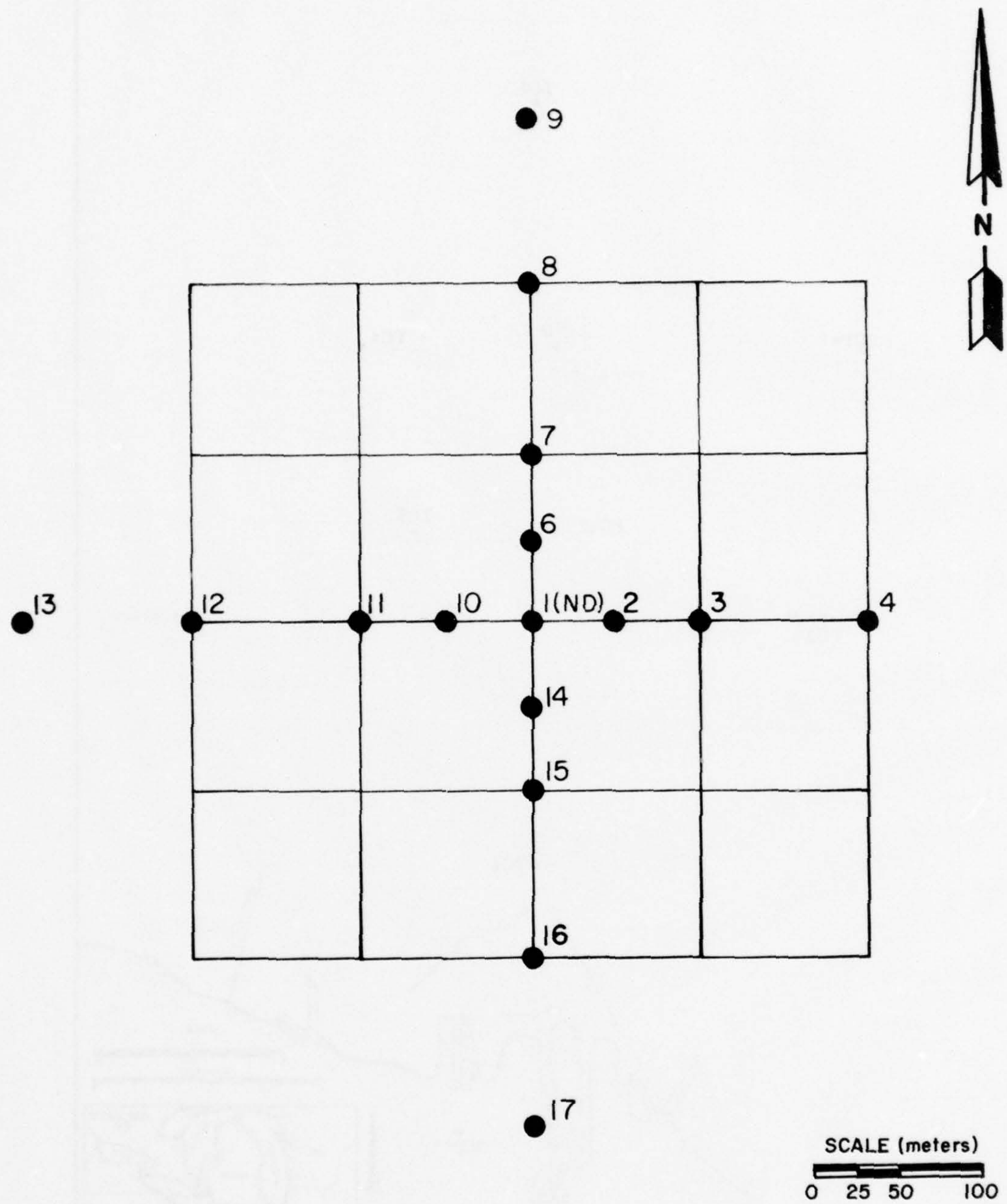

Figure B3. Survey rod and sediment trap locations on the new disposal site

traps. Sediment shear strength measurements and sediment core samples were taken at these stations to help define the sediment pile.

9. A summary of the type of measurements taken during each field trip is given in Table B1.

Review of Literature

Hydraulic regime

10. Dredged material that is deposited in Lake Erie near the Ashtabula disposal site is greatly influenced by the water motions in the lake. The physical processes that are important in determining the distribution and movement of dredged material include water level variations, wave energy, and current circulation patterns. There have been few studies of these parameters near the Ashtabula Disposal Site, but several large-scale studies on Lake Erie have provided information on the physical processes that are important near the disposal site.

11. Current and circulatory phenomena in Lake Erie represent an extremely complex interaction of geostrophic circulation, wind stress response, thermal density gradients, inertial motion, seiches, and kinetic flows related to inflowing water (Sly 1973). The combination of these mechanisms produces currents in Lake Erie that average between 7 and 10 cm/sec (Hamblin 1971). The current speeds in the hypolimnion are generally less and average about 5 cm/sec; however, speeds as high as 98.5 cm/sec have been measured (Blanton and Winklhofer 1971). Numerical modeling of the currents in Lake Erie (Gedney and Lick 1971) also indicates that the current speeds are approximately 10 cm/sec. The model also predicts that the currents are strongly dependent on the bathymetry which results in flows parallel to shore. Seiches with amplitudes of 2.56 m (McDonald 1954)

and inertial currents (Verber 1966) have also been observed in Lake Erie.

12. In addition to currents, the wave energy may also be important in reworking and resuspending dredged material. Wave action is especially important in Lake Erie as this lake is much shallower than the other Great Lakes. Wave heights of 1.5-2.0 m are common near the disposal site and the orbital velocities from these waves can readily penetrate to the bottom (Sly 1973). The mean orbital velocity at the bottom (17 m) as calculated from theoretical considerations is about 5 cm/sec (International Working Group on the Abatement and Control of Pollution from Dredging Activities 1975). The orbital velocities, however, can increase under storm conditions as wave heights may reach 4.5 m. Wave energy in conjunction with currents that are present in Lake Erie can readily resuspend and transport dredged material that has been deposited in water less than 20 m deep (Kick 1962).

13. Studies on other physical characteristics of Lake Erie have also been conducted. Water transparency studies in Lake Erie (Pinsak 1968) indicate that the water transparency near the Ashtabula disposal site varies per month from as high as 60 percent (relative to 100 percent in air) to less than 10 percent. Temperature studies in the lake indicate that there is a strong thermocline during July and August that frequently oscillates in response to wind changes (Blanton and Winklhofer 1971). The water during the winter, however, is nearly isothermal with the temperature reaching nearly 0°C (Stewart 1973).

14. The physical characteristics of the area can be greatly influenced by the local climatology. A description of the climatology of the area based on data from the U.S. Weather Service is presented in NALCO ES (1975). As discussed therein, weather in the area is affected by polar and tropical air masses as well as by moderating effects of Lake

Erie. Temperatures can vary from -28°C in the winter to as high as 37°C in the summer. The predominant wind direction is out of the south with speeds averaging between 4 and 6 m/sec. The wind speed, however, frequently exceeds 25 m/sec. The average cloud cover for the area is about 60 percent and the annual rainfall is 88.9 cm. Lake Erie is located at the junction of several major storm tracks that originate in the western portion of the Great Plains (U.S. Department of Commerce 1959). Consequently, severe storms with high winds and heavy rainfall occasionally reach the area and greatly influence the dynamics of the lake.

Sedimentation

15. The general sediment regime in the study area consists of alternating mixed deposits of sand, silt, and clay, which often contain rock fragments, pebbles, and shells. The total thickness of the sediments in the disposal area varies between 40 m and approximately 20 m.* The recent sediments consist of approximately 90 percent quartz with about 4 percent feldspars and 2 percent dolomite and other carbonates. The remainder consists of several other minerals (NALCO ES 1976). The top 10 to 15 m of sediments are of recent origin (from the last 8,000 to 10,000 yr). These sediments were in part eroded from the bluffs by rain, frost, and wave action and were deposited on numerous narrow beaches or were carried a short distance offshore (Hutton 1940). The remainder are glaciolacustrine sediments deposited by the glacial lakes Warren, Lundy, and early Lake Erie (Hough 1958). These sediments rest on top of hard till deposited during the Valders Substage and the Two Creeks Interval of the Wisconsin Glaciation. The entire unconsolidated sedimentary overburden rests on top of the Ohio Shale (Hough 1958).

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* Personal communication, Dr. C.E. Herdendorf, Center for Lake Erie Area Research, Ohio State U., Columbus, Ohio, June, 1975.

16. The sedimentation rate near Ashtabula is a maximum of 0.3 cm per year based on Cs^{137} dating (Evans 1973), while in the western Lake Erie Basin, it is about 0.1 cm per year based on C^{14} dating.* The results of studies carried out during the past two decades show that the surface portions of the sediments within the disposal site are 99 percent medium fine sand. At locations adjacent to the disposal area, the sediments consist of more than 80 percent silt with some clay and very little sand.*

17. Several attempts have been made to determine the amount and direction of sediment transport in water environments similar to that in Lake Erie. Three basic methods are generally used to estimate the sediment transport: (1) measuring sediment grain-size distributions over several time intervals and estimating the direction of transport by comparing changes in the geographic grain-size distribution patterns, (2) estimating the direction of transport by using measured water current values, and (3) tagging the sediments and tracking their movement. These three methods (or slight variations) are often used in tracking sediment movement. For example McBride (1975) used trend surface analysis on several statistics computed from particle-size distributions of sediments collected in the western basin of Lake Erie. From this analysis he determined different sources of the sediments and also the direction from the original source that the sediments were transported. This method, however, does not always work for tracking dredged material as the sediments of the original lake bottom may be indistinguishable from the disposed material and trends in the sedimen distributions may not be apparent.

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* Personal communication, Dr. C.E. Herdendorf, Center for Lake Erie Area Research, Ohio State U., Columbus, Ohio, June, 1975.

18. Predictions of sediment transport with the use of measured water current values have also met with limited success. The problem is in accurately determining the speed of the current (or boundary-shear stress) that will initiate sediment movement. Attempts to measure this parameter for various grain sizes have been made in both the marine environment and in the laboratory (e.g., Hjulstrom 1939, Sundborg 1967, and Sternberg 1972). The results from these studies, however, show considerable variation, and estimates of sediment transport based on this method can be considered as only an approximation.

19. The most promising and probably the most accurate method of tracking dredged material is by tagging the material before it is discharged into the aquatic environment. Analysis of sediment samples taken after the disposal operation can readily determine where the material has been deposited and/or transported. The major problem with the technique is finding an efficient method for tagging the material, which in many cases may be cost-prohibitive. The method of tagging the dredged material, however, has been used successfully in San Francisco Bay (Leahy et al. 1976).

PART II: FIELD AND ANALYTICAL PROCEDURES

Bathymetry

20. Bathymetric and subbottom surveys of Lake Erie were conducted using a portable Raytheon DE-719B continuous-recording fathometer (200 khz) and a Raytheon RTT-1000A Portable Survey System (7 khz) to measure and record water depth and subbottom profiles. Depth was recorded by the fathometer on chart paper with an accuracy of ± 0.5 percent of the indicated depth (± 10 cm) and at a rate of 534 soundings/min. The boat's location was determined using a Motorola Mini-Ranger Navigation system that had an accuracy of ± 3 m. Data from the navigation system and time from a digital clock (NES Model DC 1205) were recorded by an on-board digital printer (Anadex Model DP-650A) at approximately 1-sec intervals. A time mark that enabled an accurate correlation of depth and location was periodically recorded on the fathometer chart paper. The fathometer was tested at dockside by lowering an aluminum plate beneath the transducer to a depth of 4 m and checking the fathometer readings to assure that the instrument was functioning properly.

21. The Mini-Ranger was tested both in the field against survey charts and on shore against measured distances. The tests showed that the system measured within the specific given tolerance from a stationary position. Navigational precision from aboard the vessel, however, was generally not within ± 3 m, but was better than ± 10 m. Two shore stations for the Mini-Ranger transponders were established. One was located at 2631 Walnut Blvd., west of Ashtabula Harbor, while the other was located on a railroad bridge at the Cleveland Electric Illuminating Power Plant approximately 2 miles* east

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* A conversion table for converting U.S. customary units of measurement to metric (SI) can be found on page xiii.

of the harbor. The distance between these two stations, which was the baseline for the plotting procedures, was determined by surveying in the two shore stations with a Lietz T60D Theodolite (accuracy of ± 30 sec of arc). The distance, calculated from the measured angles and with distances measured with the Mini-Ranger, was determined to be 4754 m.

22. During the periods 23-27 June and 7-11 July 1975, large-scale and detailed bathymetric and subbottom surveys were conducted to establish baseline reference for the study area. The large-scale survey taken before the disposal operation consisted of 22 north-south transects at approximately 300-m intervals covering the entire 35-sq km study area. The same measurements were taken again in September 1976 so that changes in the bathymetry could be determined.

23. Four control transects were established to monitor large-scale seasonal changes that might occur within the study area. The transects were approximately 7 km long and oriented north-south. These transects were surveyed monthly and the results were plotted and examined to detect any changes in bottom contours. These transects were also used to estimate the precision of the fathometer and the accuracy of the positioning techniques.

24. Detailed surveys in the vicinity of disposal sites D2, D8, and ND were conducted before and after disposal operations. These surveys were used to examine the size of the sediment pile and monitor changes within and resulting from the disposed sediment. Radial survey patterns centered on the disposal area as well as rectangular grid patterns were used to survey the disposal sites. The combined data from the two types of surveys were used to develop the bathymetry plots.

25. Bathymetric records were digitized and the depth correlated with location. Corrections for changes in lake level elevation were based upon hourly lake level data

acquired from the Lake Erie Survey Station in Fairport, Ohio, located 20 miles west of Ashtabula. All data were then adjusted to the low water datum elevation that is 576.8 ft above mean water level at Father Point, Quebec (International Great Lakes Datum "IGLD" 1955). Location and depth were plotted and contoured with a general purpose contour package (Calcomp). The bathymetry plots of the disposal areas centered on D2, D8, and ND were used to examine the distribution and volume of the dredged material by comparing the predisposal and postdisposal contours.

Currents

Time continuous current measurements

26. A permanent mooring was installed in 17 m of water at location PC1 on 8 July 1975. ENDECO Type 105 current meters and Type 109 thermographs were secured to the mooring at 1 and 3 m above the bottom (Figure B4). Current speed and direction were recorded as 30-min averages continuously from June 1975 to September 1976. The instruments were serviced monthly, which included replacing of batteries, film, and desiccant bags and checking the instrument trim.

27. The current meters were axial flow, ducted impeller instruments specifically designed for use in the near shore zone (Figure A'1*). Analog values of impeller rotation and magnetic bearing of the instrument comprise the data that were recorded on 16-mm film. Each instrument was calibrated prior to installation in a closely controlled flume to determine threshold speed and accuracy of measurement. The most recent calibrations were conducted by personnel at the Environmental Devices Corporation (ENDECO). Threshold speeds were determined for each current meter and were found to be

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* Diagrams of equipment are given in Appendix A'.

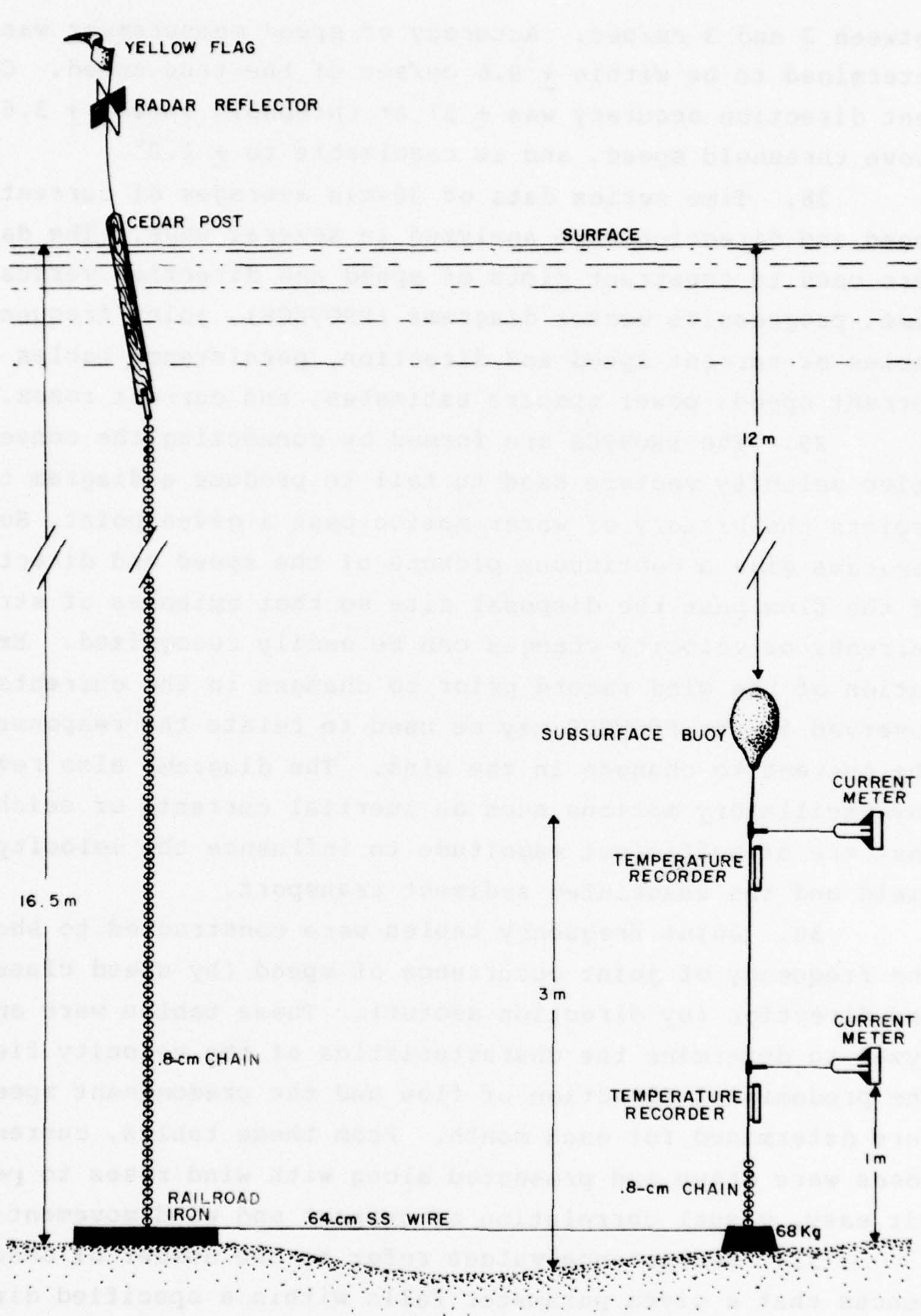


Figure B4. Current meter and thermograph mooring

between 2 and 3 cm/sec. Accuracy of speed measurement was determined to be within ± 0.6 cm/sec of the true speed. Current direction accuracy was ± 5° at threshold speed, ± 3.6° above threshold speed, and is resolvable to ± 1.0°.

28. Time series data of 30-min averages of current speed and direction were analyzed in several ways. The data were used to construct plots of speed and direction versus time, progressive vector diagrams (PROVECS), joint frequency tables of current speed and direction, persistence tables of current speed, power spectra estimates, and current roses.

29. The PROVECS are formed by connecting the consecutive velocity vectors head to tail to produce a diagram that depicts the history of water motion past a given point. Such diagrams give a continuous picture of the speed and direction of the flow past the disposal site so that episodes of strong currents or velocity changes can be easily recognized. Examination of the wind record prior to changes in the currents observed in the PROVECS may be used to relate the response of the current to changes in the wind. The diagrams also reveal any oscillatory motions such as inertial currents or seiching that are of sufficient magnitude to influence the velocity field and the associated sediment transport.

30. Joint frequency tables were constructed to show the frequency of joint occurrence of speed (by speed class) and direction (by direction sector). These tables were analyzed to determine the characteristics of the velocity field. The predominant direction of flow and the predominant speed were determined for each month. From these tables, current roses were drawn and presented along with wind roses to permit easy, visual correlation of current and wind movement.

31. Persistence values refer to the number of occurrences that a given parameter falls within a specified direction or speed class for a specified time (1 hr, 2 hr, etc.). Persistence values were computed from the current-meter data

and the persistence tables were scanned to locate episodes of consistently high current velocities that indicated possible periods of high erosion. The wind record was then examined to determine what wind conditions were associated with the strong currents.

32. Power spectra of the components of the velocity time series were estimated with a standard fast Fourier transform (FFT) computer program (Cooley and Tukey 1965). Sixty-five frequency bands and 2048 data points were used for each power spectra estimate. The data were converted to 2-hr averages before the analysis was performed. Spectra from each current-meter record were used to examine the relative importance of any periodic components in the velocity. The oscillatory currents that were examined were the inertial currents (17.9 hr), semidiurnal tide (12 hr), and the first longitudinal mode of Lake Erie (14.1 hr).

33. The current-meter data were also used to estimate the sediment transport. A computer program, SEDMOT (McClennen and Kramer 1976), was first given the erosional and depositional velocities of five sediment grain sizes as determined by the Hjulstrom Curve (Hjulstrom 1939). The program then scanned the current-meter records to locate episodes when each of the five grain sizes was in suspension. Progressive vector plots of the currents for these episodes were made that were actually estimates of the sediment transport. The plots began whenever the currents exceeded the given erosion velocity for each particle size and ended when the speed fell below the given deposition velocity. These plots were used as a theoretical estimate of sediment movement.

Over-the-side current measurements

34. Vertical profiles of the currents were taken each month at locations PC1 and TC1-TC6 with an electromagnetic current meter (Marsh-McBirney Model 727). Currents were normally measured at 1 and 3 m above bottom, middepth, and at

1 m below the surface. The output signals of the electromagnetic current meter were recorded by a Rikadenki three-pen analog recorder (Model B38). The instruments were linked to a Nova Inverter to eliminate electronic interference from the boat's generator. The analog recording of the X and Y velocities and the orientation of the current meter case were digitized in the laboratory for analyses.

35. The current meter has a stated threshold velocity of 0.6 cm/sec, which is also the resolution of the recorded velocity components. Absolute accuracy of the measurements is specified as being $\pm$ 2 percent of the instrument readout. Maximum long-term drift, which is an inherent instrument error, is approximately 1.9 cm/sec. Consequently, under worst case conditions of large zero-drift, the measurements could be in error by as much as 2 cm/sec. Additional error can be induced into the measurements if there is substantial vertical movement of the instrument such as induced by wave action on the boat.

36. The current-meter probe was held at each depth for 3 min, and the continuous measurements for each depth were averaged to determine the current velocity. The results were plotted so that vertical shears in the horizontal velocity could be readily observed. These measurements were used during the disposal operations to quickly assess the relative direction of current movement with depth in order to position anchored survey vessels. The measurements were also intended to provide information on the horizontal and vertical variability of the currents.

Temperature Measurements

Continuous temperature measurements

37. Continuous temperature measurements were made concurrently with the permanent current meter measurements.

Two ENDECO type 109 recording thermographs (Figure A'2) were attached to the mooring, one directly beneath each current meter. The two thermographs recorded half-hourly averaged temperature on 16-mm film with a resolution of 0.1°C and an accuracy of ± 0.2°C. The time constant of the instrument was 10 min. The thermographs were serviced simultaneously with the current meters with the replenishment of new batteries, film, and desiccant bags.

38. Half-hourly averages of temperature versus time were plotted for each month and each station. The maximum, minimum, and mean temperatures were determined for each month and compared by station and month. Episodes of large temperature fluctuations were noted, and the wind record and current meter records were examined to locate possible causes for the variations.

Temperature profile measurements

39. Measurements of ambient temperature profiles at stations TC1-TC6, PC1, and ND were made monthly between July 1975 and September 1976 (with the exception of December 1975, and January, February, and August 1976) as well as during disposal operations using a precision thermistor temperature probe (M & F Engineering). This instrument provided a resolution of 0.01° C and an accuracy of 0.05° C. Temperature measurements were made at 1- to 2-m depth intervals. Vertical temperature profiles were plotted for each transect with a computer plotting package and noticeable changes in the thermocline were examined.

Transmissivity

40. Transmissivity measurements were taken monthly and during disposal operations with a Montedoro-Whitney TMA-1A Transmissometer. This instrument measured the percent of light that was transmitted across the 1-m span between the

light source and the sensor. The instrument was designed to work accurately in water up to 100 m deep. The relative accuracy was 2 percent with a resolution of 1 percent of the range. The instrument was balanced at every station before obtaining measurements by setting the absorbed light level to 100 percent with the probe in the air and the mirror and light windows wiped clean. The source was then covered with a piece of cardboard and the readout adjusted to 0 percent. Readings were then obtained at 1- or 2-m increments to the bottom. The data were plotted by computer on the same graphs as the temperature data. The data obtained during disposal activity in 1975 were computer plotted in three dimensions representing the time variations of transmissivity within the water column.

41. During the dredging operation in 1975, five transmissometers were used to measure changes in the transmissivity resulting from the disposal activity. An attempt was made to intercalibrate the transmissometers but the readings varied considerably, and it was impossible to convert the values from each transmissometer to a standard scale. Consequently the values presented only show relative changes in the transmissivity and the measurements given are the percent of light transmittance in the water relative to 100 percent in air. An attempt was also made to compare total suspended sediment measurements with the transmissivity but the data were so variable that no useful correlation could be made.

Waves

42. Wave measurements were made with a Bass Engineering Model WG/100M self-contained wave measuring and recording system that was installed in approximately 17 m of water near station PC1. The instrument sensed pressure fluctuations with

a *Bourdon* tube pressure transducer whose signal was transformed with an optical lever system to produce a variable voltage output. The operation of the optical lever system (Figure A'3) is described in detail by Bass and Byrnes (1974). This system determined water surface variations with a precision of ± 0.02 ft and a resolution of ± 0.01 ft. The timing was controlled by a crystal clock that had an accuracy of ± 0.01 percent. The wave field was sampled every 4 hr for a 10-min interval during which time measurements were taken every 0.5 sec. In March 1976 the sampling rate was changed to 1.0 sec to increase the recording capacity of the instrument. The data were recorded on a magnetic cassette that was later decoded. The results were then stored on magnetic tape.

43. The data were edited to remove all non-numeric digits from the data and also to check for the proper timing sequence that precedes each data set. The resulting data sets were then detrended and the mean was subtracted, which left only the pressure fluctuations about a zero mean. The residual pressure readings were subsequently plotted and examined visually to remove any outlying points. All erroneous points were replaced by a linear interpolation of the two adjacent points. The clean data sets obtained after the editing process were used for subsequent analyses.

44. The consecutive zero-up-crossing method was used to analyze the large amount of wave data. This method defined the point where the water-level signal changed from negative to positive as the beginning of a wave and the next zero-up-crossing as the end of the wave. Each wave height was determined by calculating the difference between the maximum and minimum water-level values between consecutive zero-up-crossings, and the wave period was simply the time interval between up-crossings. The entire data set for each 10-min recording interval was analyzed in this manner and, typically, 100 waves were tabulated. These waves were then sorted

according to wave height and the highest one-third were averaged to determine the significant wave height for that recording interval. The periods of the highest one-third waves were then averaged to determine the significant wave period.

45. The wave gauge was located so deep that the pressure signals from small waves were extremely weak. Consequently, the results were further edited to eliminate values that were below the detection limits of the instrument. These weak signals produced such small fluctuations in the measured water levels that the zero-up-crossing method was not effective in locating the beginning and ending of the waves. As a result, very long period waves were frequently recorded. To eliminate this problem, an arbitrary cut-off period of 10 sec was assigned. Waves with periods greater than 10 sec were considered erroneous and deleted from the record. This may have deleted a few good data points, but waves with periods greater than 10 sec are extremely uncommon on the Great Lakes (Liu and Kessenich 1975); when they do exist, it is only under severe storm conditions. After these bad points were deleted, each recording interval was visually examined and records with less than 20 remaining good wave values were considered untrustworthy and eliminated. Significant wave heights and wave periods were then calculated for the remaining data sets as described above.

46. Since the wave gauge was located on the bottom and since the pressure signals from water-level fluctuations decreased with depth in the water column, the measured wave height values were corrected to estimate the actual wave heights at the water surface. The corrections for this attenuation of the pressure fluctuations with depth were made as described by Kim and Simons (1974). The wave height at the surface H is related to the measured wave at the bottom H_b by the equation

$$H = \frac{\cosh (KD)}{\cosh K(D-Z)} H_b \qquad (1)$$

where: D = total water depth

K = wave number

Z = depth of the sensor

The wave number was determined implicitly from the dispersion equation

$$\omega^2 = gK \tanh (KD) \qquad (2)$$

where: ω = wave frequency = 2π/period

g = acceleration due to gravity

The procedure followed was to first determine H_b from the zero-up-crossing method and then compute H from Equation 1. Equation 2 was used to calculate K, which used the wave period determined from the zero-up-crossing routine. An estimation of the maximum value of the elliptical velocity of the wave field at the bottom was then made by using H_b according to

$$\text{Orbital Velocity (OV)} = \frac{1}{2}\omega H_b = \pi H_b/\text{Period} \qquad (3)$$

A similar method for computing orbital velocities is described in detail by Kinsman (1965).

47. The final result of the wave record analysis was a tabulation of significant wave height and wave period recorded every 4 hr while the instrument was in operation. The OV estimations near the bottom were also tabulated for each 4-hr interval as was the wind speed during the time of the observation.

48. In addition to the wave-recorder data, wave direction data were collected twice each day by observers at locations west (Walnut Boulevard) and east (Lake Road East) of

Ashtabula Harbor. Each observer was provided with a Lensatic compass and instructed to sight perpendicular and parallel to the wave crests as far offshore as possible and determine the direction from which waves were propagating. Time of day and occasional wave-height estimates were also recorded. Histograms of wave direction by compass sector were developed from these data.

Meteorology

49. A 10-m crank-up tower was erected approximately 1 km inland from the harbor. A Meteorology Research Incorporated Model 1071 Mechanical Weather Station was secured to the top of the tower and analog values of wind run, wind direction, and air temperature were continuously recorded. The threshold of the instrument was 0.34 m/sec for both the vane and the cup anemometer. The speed was recorded with an accuracy of $\pm$ 2 percent of the measured value and the direction with an accuracy of $\pm$ 3.6° and a resolution of 15°. The weather station was serviced monthly, which included the replacement of batteries and strip-chart paper.

50. The data were read from the analog records and digitized as hourly averages. The results were then used to construct plots of speed and direction versus time and also to make PROVECS, joint frequency tables of wind speed and direction, and persistence tables of wind speed. Hourly temperature data, which were recorded with an accuracy of $\pm$ 1°C, were also tabulated. An Eppley Black and White Pyranometer Model 8-48 was installed approximately 3 m aboveground on the south side of a tower at Sutherland Marina, Ashtabula. The instrument recorded the solar radiation in langleys per minute with an accuracy of $\pm$ 2 percent of the measured value. An analog recorder for the solar-radiation data was placed inside a trailer next to the tower. No shadows from obstructions

were cast on the pyranometer at anytime during the day. It was cleaned and serviced monthly.

Hydrology

51. Hourly lake level data collected at Fairport Harbor, Ohio, (20 miles west of Ashtabula) were obtained from Lake Survey Center in Rockville, Maryland. Ashtabula River discharge data were obtained from the United States Geological Survey (USGS) in New Philadelphia, Ohio. Daily values of water level and river discharge were tabulated as well as hourly water-level values during periods when the bathymetric surveys were being conducted.

Sedimentology

Sediment traps and survey rods

52. Traps for collecting suspended sediments were designed and implemented as a means for studying sediment distribution and movement. The purpose of the sediment traps was to collect suspended sediments that were disposed by a dredging vessel or resuspended by current and wave activity. By using a number of sediment traps in a grid system, sediment distribution and movement patterns were determined by analysis of the trap contents.

53. The sediment traps were constructed as shown in Figure B5. The collection tubes were plastic core liners 30 and 50 cm long that were closed on the bottom with a plastic cap. The longer traps were used near the center of the disposal area where deposition would be the greatest. Traps and holders were installed and retrieved by a diver; the traps were covered prior to retrieval with a plastic cap having a pressure-release hole. No disturbance of the samples was observed during the trap removals.

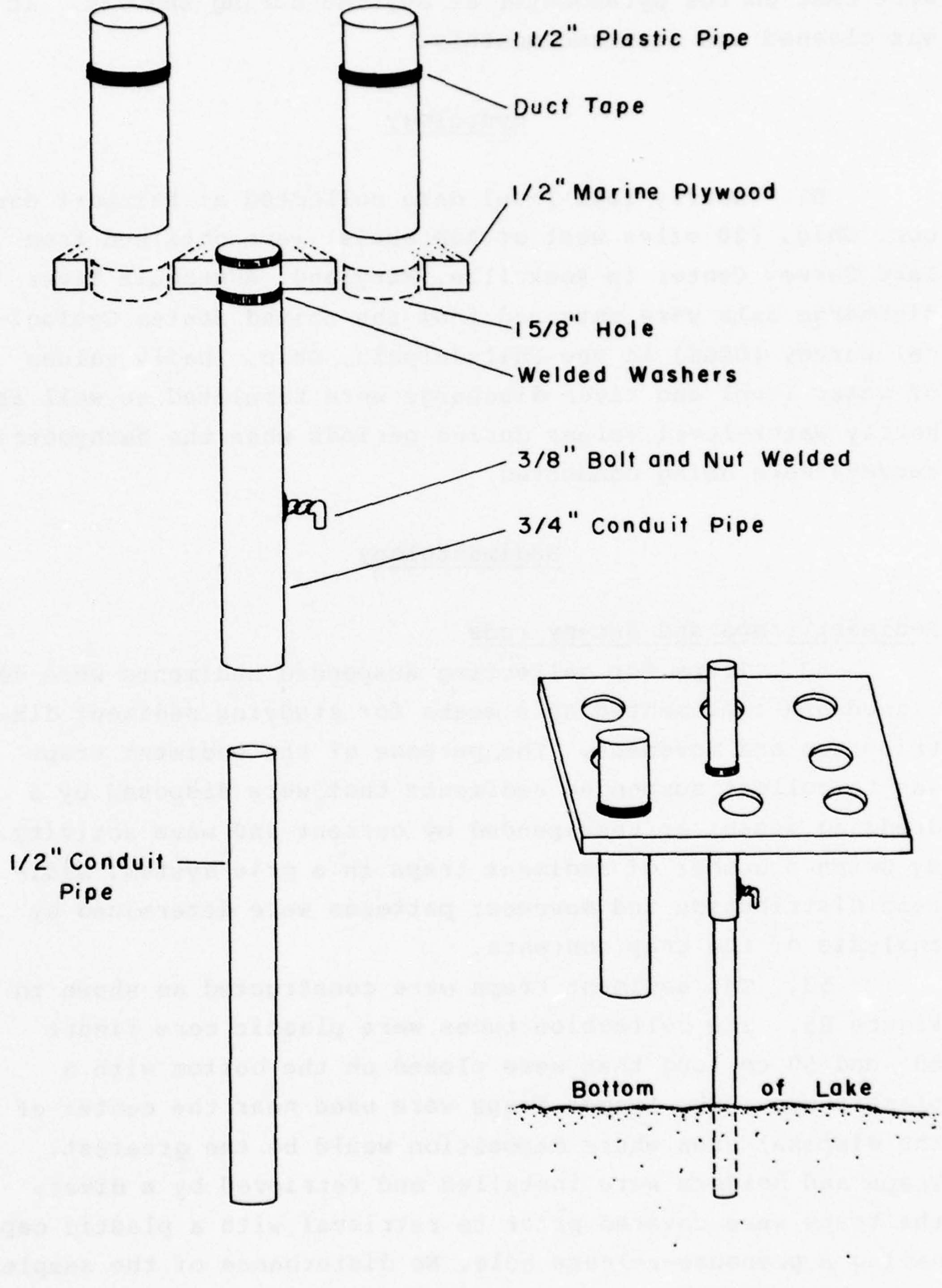


Figure B5. Diagram of sediment traps

54. The location of the traps was marked with a 1.5-m-long red cedar post, which was secured to the lake bottom near the traps by a 0.625-cm polypropylene line attached to two concrete blocks. It was found that this arrangement was able to withstand several lake storms.

55. Of the eight sediment traps at each site, two were collected for analysis during each field study and the others were left undisturbed. This provided information on the compaction rate of the sediments and the characteristics of their vertical distribution. The samples collected from the traps as well as grab samples and cores were analyzed for grain-size distribution by the Great Lakes Laboratory. The compaction rate of the sediments was estimated by comparing the height of the sediment in the traps from the final collection with the height of the sediment from the previous postdisposal samples. This, of course, assumed that only negligible sedimentation occurred in the months following the disposal operation, which was verified with data from control site C3.

56. In order to collect additional data on the amount of sediments deposited, survey rods were installed next to the traps. These steel survey rods were made of 1.8-m-long and 0.937-cm-thick concrete reinforcement rods. The rods were inserted next to the traps to measure the total quantity of sediment accumulation. The rods were painted white, then graduated with black paint and rings of duct tape so that the diver could feel the graduations along the rod during periods of low visibility. A steel plate 10 cm square was welded to the lowest portion of the graduated rod, which prevented it from sinking into the mud. When scouring around the rod occurred, the depth was obtained from the edges of the depressions, rather than the center.

57. The readings from the surveys rods and sediment traps were contoured to show the variations of the sediment

pile for the duration of the study. The total amount of compaction and erosion of the sediment pile that had occurred in the months following the disposal operation was determined by comparing the three postdisposal readings.

Sediment shear strength

58. The shear strength of the sediments was measured in situ with a specially designed instrument. The instrument was made from a torque screwdriver with an attached, calibrated scale for reading the torque values (Figure A'4). Two different instruments were made: one with a 0- to 6-oz-in scale for the very loose sediment and the other with a 0- to 48-oz-in scale for the sediments with greater shear strengths.

59. To obtain the measurements, the diver carefully pushed the vane into the sediment to a predetermined depth and then rotated the handle slowly until the sediment began to shear. The torque required to produce the shear was read directly from the instrument and recorded. The torque values were converted to pounds per square inch by the method described by Dill and Moore (1965).

60. Shear strength measurements were taken at 5-cm intervals down to a depth of 30 cm at each station. The measurements were taken at the same stations where the sediment traps and survey rods were located. The results were tabulated as well as plotted and contoured on a base chart. Vertical profiles of the sediment shear strength were also plotted for both north-south and east-west transects.

Sediment cores

61. Over 200 sediment cores were taken by Great Lakes Laboratory with a Wilco Gravity Corer. Samples were collected from sites within the disposal area and the control area during monthly sampling periods in 1975 and 1976. Four replicates were collected for all the 1975 samples and two replicates were taken for the 1976 samples. Three different sections from each core, at approximately 7-cm intervals,

were analyzed for particle-size distribution by means of the F.A.S.T. technique (Rukavina and Duncan 1970). These data were recorded in weight percent and then plotted as weight percent vs. grain size (in phi units). The data plotted were the mean average of the replicates. The purpose of these plots was to provide a quick check on the distribution of the sediments.

62. Eleven additional sediment cores were collected by a diver in the new disposal site during 1976. The core samples were X-rayed at the Department of Geological Sciences, University of Toledo, Toledo, Ohio. Radiographs as well as X-ray transmission plots for two energy levels were made of each sample to show structures of the sediments, density differences, coarse particles, bioturbations, and porosity discontinuities within the cores.

Statistical techniques

63. 1975 Data. Linear discriminate analysis using the program Statistical Packages for the Social Sciences (SPSS), version 6.51, (Nie, et al. 1975), was used to examine the impact of the disposal operation on the sediment grain-size distribution. For each sample the calculated percentages of sand, silt, and clay were used as dependent variables in the analysis, which was initially performed for each location using four replicates. Three groups were defined by time such that one group consisted of the data collected at one location prior to disposal, the next group included the data at the same location after disposal, and the third group included the data for the subsequent sampling period (this analysis was also done with a fourth group, the 17 November data).

64. The canonical plots developed from linear discriminate analysis gave a two-dimensional representation of the variations at each location over time. Discussions on how such plots are generated can be found in Nie et al. (1975),

and Rao (1970). The plots were generated first by including all four of the sampling dates from 9 July through 17 November. Several storms in November prior to sampling changed the sediment grain-size distribution considerably. It was feared that this would distort the statistical analysis; therefore, plots were also generated without the poststorm data.

65. A multivariate analysis of variance was conducted using the SPSS program MANOVA (Cohen and Burns 1973) to test the hypothesis of no interaction between control and disposal sites, and predisposal and postdiposal data with untransformed percentages of sand, silt, and clay as the dependent variables. The reason for using multivariate analysis as opposed to univariate analysis was a possible increase in sensitivity and more concise summary statistics. It was possible, because of high correlations between dependent variables, that a univariate analysis that analyzes the dependent variable separately might not show significance while a multivariate analysis would (Kramer and Jensen 1969).

66. For the multivariate analysis of variance, locations were grouped into three categories: control site, harbor disposal site (D2) and river disposal site (D8) (Figure B1). This type of grouping was anticipated because no material was deposited at the control sites, and different material was deposited at the two disposal sites (harbor material at D2 and river material at D8).

67. The control site was comprised of four locations C1, C2, C3, and C4. It was desirable to compare these control locations with four disposal locations. Hence the D2 group was made up of locations D1, D2, D4, and D5, and the D8 group consisted of locations D7, D8, D10, and D11. Stations D3, D6, D9, and D12 (Figure B1) were thus excluded for the following physical reasons. Stations D6 and D12 were far enough from the center of the disposal sites (about 300 m) so that no dredged material was expected to travel that far

in significant quantities. Stations D3 and D9, on the other hand, were located south of the disposal sites; a comparison of the predisposal and postdisposal data revealed no significant change in sediment distribution at these stations due to the dredging disposal operations. This was expected because the dredge always disposed of its load north of the center buoy, and the majority of the sediments fell straight to the bottom without moving very far laterally. It was felt that little information would be lost by deleting these four stations.

68. The exclusion of stations D3, D6, D9, and D12 also helped to preserve the desirable properties of the analysis of variance when equal replicates were used. Statistically this was considered to be particularly important as: (1) the cell frequencies in MANOVA had to be kept uniform to avoid confounding of interaction with the main effects; and (2) it might mitigate any adverse effects of violating the assumption of equal variance-covariance matrices (Morrison 1967).

69. The four replicates taken at each of the four locations for each group, control site, D2 and D8, resulted in 16 replicates per cell in the MANOVA. A design was made with a 3 by 2 factorial with time as one factor, the periods being 31 July, 19 August, and 13 September, and the control and the D2 group constituting the other factor. This analysis was then repeated substituting the D8 group for the D2 group. The assumptions involved were that the vector observations were independent, that they follow a multivariate normal distribution, and that the variance-covariance matrices were equal (Morrison 1967). There was no evidence that these assumptions were unreasonable. The independence property was largely fulfilled by the nature of the sampling method employed. The multivariate central limit theorem in conjunction with the sample size (16 replicates per cell) should result

in a good approximation to normality. The uniform cell frequencies supported the last assumption. The hypothesis of interest was whether the interactions between locations and time were statistically different from zero, i.e., was there evidence that disposal would affect the composition of sediments as portrayed by the vector observations. If so, one would expect the most dramatic change for the experimental locations to occur immediately after disposal operations.

70. Using this model and the hypothesis of no interaction effect the results were highly significant ($p < 0.001$) for both analyses, control vs D2 and control vs D8 over time. The computer program MANOVA was used to obtain correlations of the dependent variable and the first canonical variable. A univariate analysis of variance for each variable was also performed using the same design as above. The results of both indicated that for this set of data multivariate and univariate analyses gave substantially similar results.

71. To better understand the significant interactions Scheffe's multiple comparison procedure was used (Scheffe 1959) for each significant univariate analysis. If the original design were expressed as

Time:	July	Aug	Sep
Control Location:	θ_{11}	θ_{12}	θ_{13}
Experimental Location:	θ_{21}	θ_{22}	θ_{23}

where θ is the average of 16 replicates for each cell, then the two hypotheses of interest were

$$H_1: \quad \frac{\theta_{11} + \theta_{22}}{2} = \frac{\theta_{12} + \theta_{21}}{2}$$

and

$$H_2: \quad \frac{\theta_{12} + \theta_{23}}{2} = \frac{\theta_{13} + \theta_{22}}{2}$$

The Scheffe contrasts were used to test for statistically significant interactions within individual groups over time.

72. 1976 Data. The data for the 1976 disposal operation were treated somewhat differently. There were eleven different grain sizes and two replicates to be used. The mean of the two replicates was used for the analysis. A stepwise discriminate analysis was performed using the computer program BMDP7M (Dixon 1975) to explore the possible separation of the predisposal and postdisposal data based on different properties of the materials. The 16 stations (Figure B3) were used as replicates. The variables for the sediments were all 11 grain sizes. The values were not standardized since the units for the 11 variables were the same.

Monitoring During Disposal Operations

73. Concentrated monitoring of currents, temperature, and transmissivity was conducted during the actual disposal operations. Two separate operations were monitored: one in August 1975 and the other in May 1976.

74. The first disposal operation was conducted on 5 and 8 August 1975 by the dredge MARKHAM at the disposal sites D2 and D8. Measurements were taken immediately prior to each disposal operation to determine the ambient current, temperature, and transmissivity values. The current data were used to position anchored vessels downcurrent from the disposal site. Upon release of the dredged material, the anchored vessels measured vertical profiles of transmissivity at 10- to 15-min intervals for approximately 60 to 80 min. A moving vessel measured vertical profiles of transmissivity within the plume by following the visible plume.

75. The temperature and transmissivity were plotted versus depth for each anchored vessel location for the 5 August disposal. In addition, three-dimensional plots of

the transmissivity were constructed that illustrated the flow of the sediment plume past the anchored vessels. The plume velocity was estimated by calculating the elapsed time between the disposal of the dredged material and the arrival of the plume at the anchored vessels.

76. The second disposal operation was conducted during May 1976 by the dredge HOFFMAN at the new disposal site. The suspended sediment plume resulting from the dredged material disposal was acoustically monitored with fathometers aboard two vessels. Immediately following the discharge of dredged material, the two moving vessels recorded the depth and lateral extent of the plume with the fathometers by moving in zigzag patterns across the plume. Water samples were also collected during the operation near the edge of the plume. These samples were analyzed by Great Lakes Laboratory for total suspended sediments and turbidity. The results were compared with the acoustic profiles to show how different suspended sediment concentrations appeared on the acoustic profiles. An attempt was made to plot the movement of the plume with the fathometer readings, but the plume dispersed too quickly and synoptic readings of the plume's size and shape were not possible. Difficulties were also encountered in comparing the readings from the two fathometers as well as determining the exact position of vessels while the measurements were made. The Mini-Ranger Navigation system did not work well in the proximity of the dredge.

77. While the two moving vessels tracked the sediment plume, two anchored vessels (the DAMBACH and a vessel from John Carroll University) monitored temperature, currents, and water chemistry. The current and temperature measurements were taken from aboard the DAMBACH, which was tethered to the center buoy that marked the disposal site. Temperature and currents were continuously monitored at two levels (1 and 8 m off the bottom) with an M and F Engineering temperature probe and a Marsh-McBirney Model 727 current meter.

PART III: RESULTS AND DISCUSSION

Bathymetry

78. A bathymetric chart of the study area for July 1975 is presented in Figure B6. The study area can be divided into four distinct topographic regions: (1) a relatively smooth control area with a low relief of approximately 1 m/km; (2) a terrace with two depressions immediately to the north of the control area (this terrace has a grade of 0.5 m over 1 km and strikes from northeast to southwest); (3) a disposal area to the east of the terrace characterized by rugged topography as a result of earlier disposal; and (4) a smooth, gently undulating topography beyond the 18.0-m isobath that slopes gradually towards the lake center (1 m/km).

79. The bathymetry data were compared with depths in the same area presented by Herdendorf (1967). No obvious differences were observed.

80. Another chart was compiled for September 1976 (Figure B7) to see if significant changes had occurred since the 1975 survey. A comparison of these two charts revealed that the general trends in the bottom configuration were approximately the same during the two surveys. There does, however, appear to be a relatively systematic difference of approximately 0.5 m between the two charts that can not be accounted for. Consequently, emphasis was placed on relative depth differences over the study area for each survey when comparing the two charts. Both surveys showed a mound near the center of the disposal area and a basin near the western edge. Discrepancies between the contours were probably the result of the coarseness of the sampling grid. The disposal operations in 1975 and 1976 seemed to have little discernible effect on the bathymetry of the area.

81. Detailed bathymetry plots of data collected before

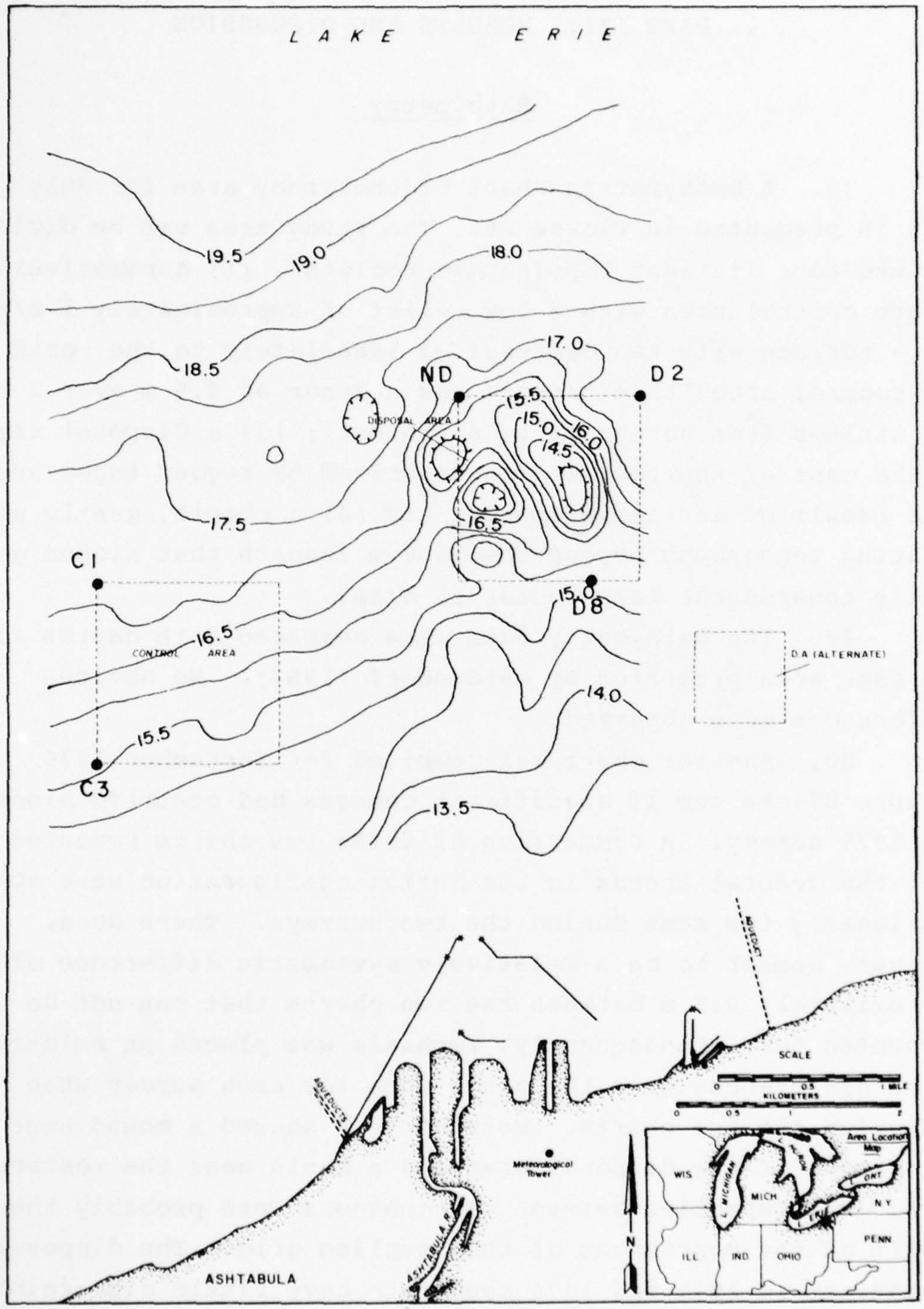
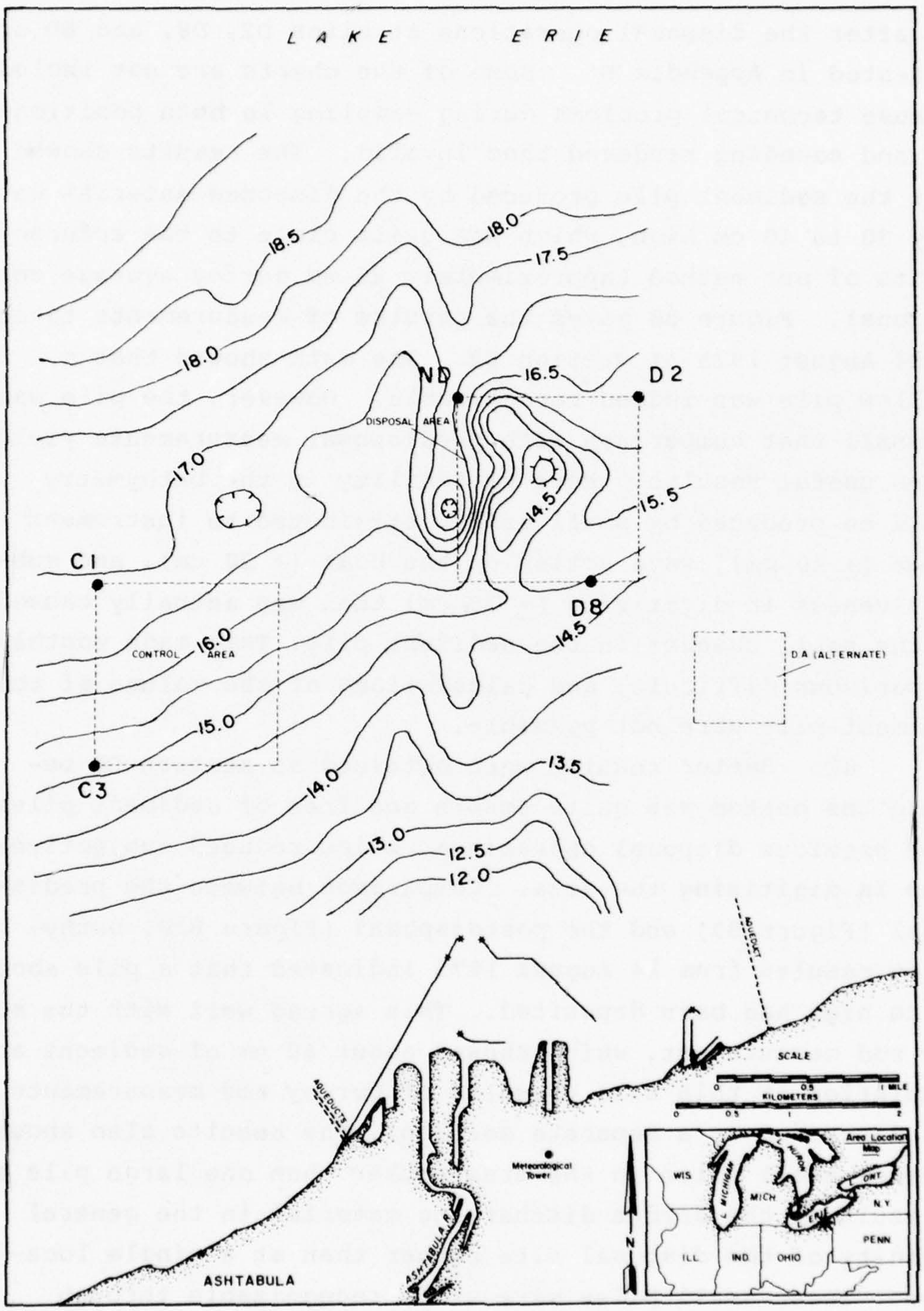


Figure B6. Large-scale bathymetry for July 1975, depth contours are in meters



Fibure B7. Large-scale bathymetry for September 1976, depth contours are in meters

and after the disposal operations at sites D2, D8, and ND are presented in Appendix B'. Some of the charts are not included because technical problems during sampling in both positioning and sounding rendered them invalid. The results showed that the sediment pile produced by the disposed material was only 30 to 40 cm high, which was quite close to the accuracy limits of our method (approximately 25 cm during average conditions). Figure B8 gives the results of measurements taken on 14 August 1975 at station D2. The data showed that a shallow pile was indeed recognizable. However, the pile was so small that comparison with predisposal measurements yielded no useful results. More variability in the bathymetry could be produced by small errors attributed to instrument error ($\pm$ 10 cm), wave action on the boat ($\pm$ 20 cm), and subjectiveness in digitizing ($\pm$ 20 cm) than was actually caused by the small changes in the sediment pile. This made monthly comparisons difficult, and calculations of the volume of the sediment pile were not possible.

82. Better results were obtained at station D8 because the bottom was quite smooth and free of sediment piles from previous disposal operations, which reduced subjectiveness in digitizing the data. Comparison between the predisposal (Figure B9) and the postdisposal (Figure B10) bathymetry results from 14 August 1975 indicated that a pile about 50 cm high had been deposited. This agreed well with the survey rod measurement, which showed about 40 cm of sediment accumulation at this site (results of survey rod measurements are discussed in a separate section). The results also showed several small piles in the area rather than one large pile as a result of the dredge discharging material in the general vicinity of the disposal site rather than at a single location. These small piles were still recognizable through April 1976, but by June 1976 the piles were not discernible (Figure B'18).

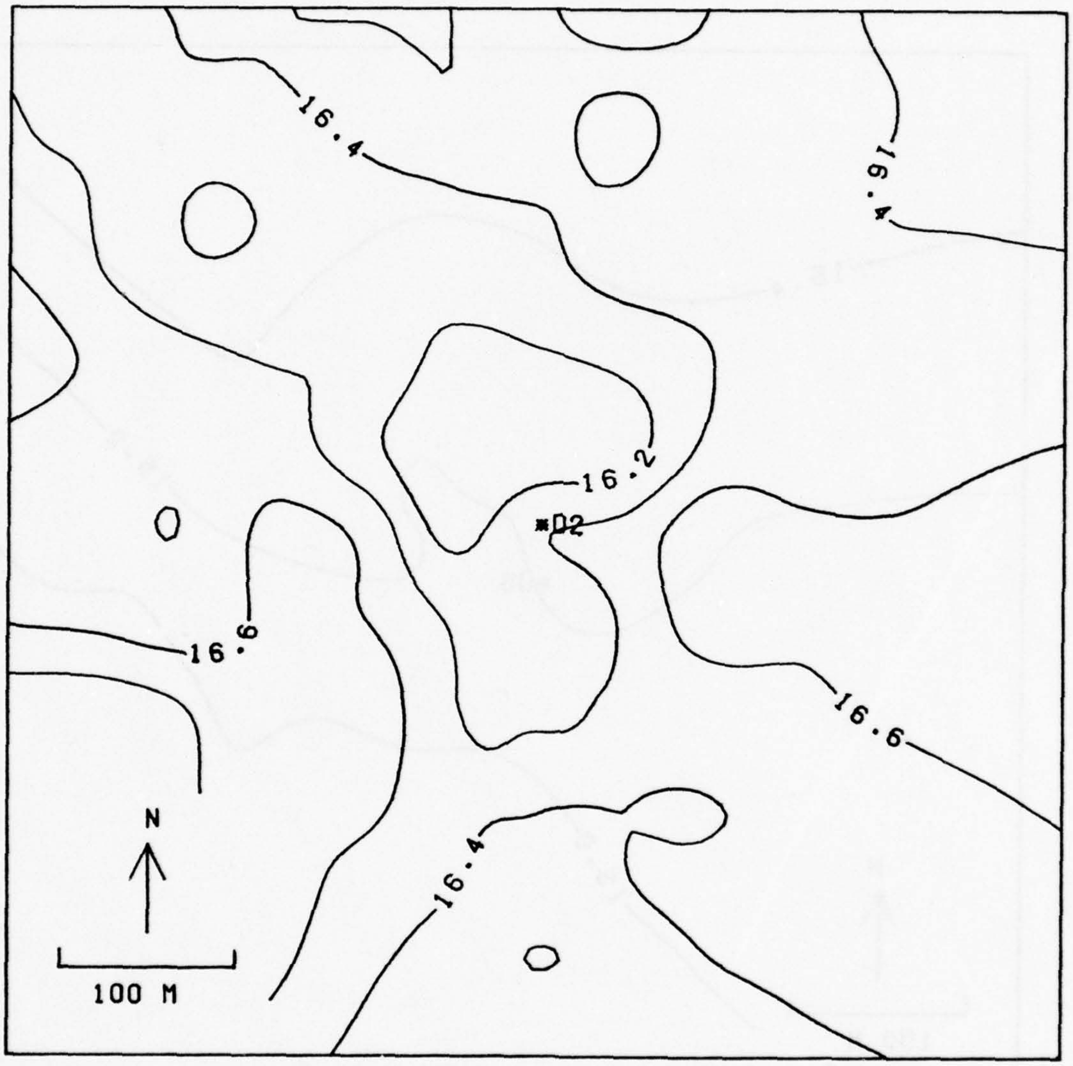


Figure B8. Detailed bathymetry for 14 August 1975 at station D2 showing small sediment pile, depth contours are in meters

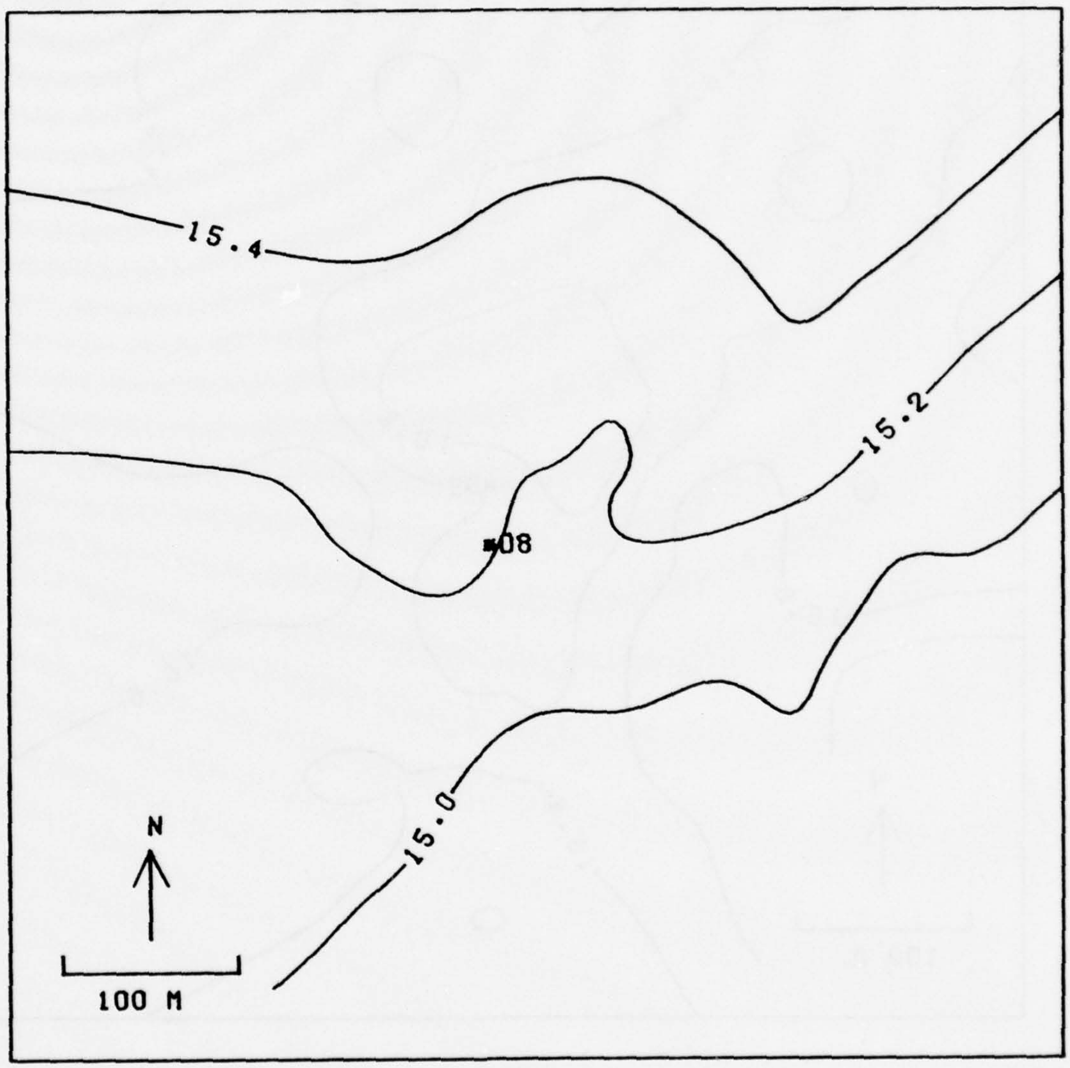


Figure B9. Predisposal bathymetry for 2 August 1975 at station D8, depth contours are in meters

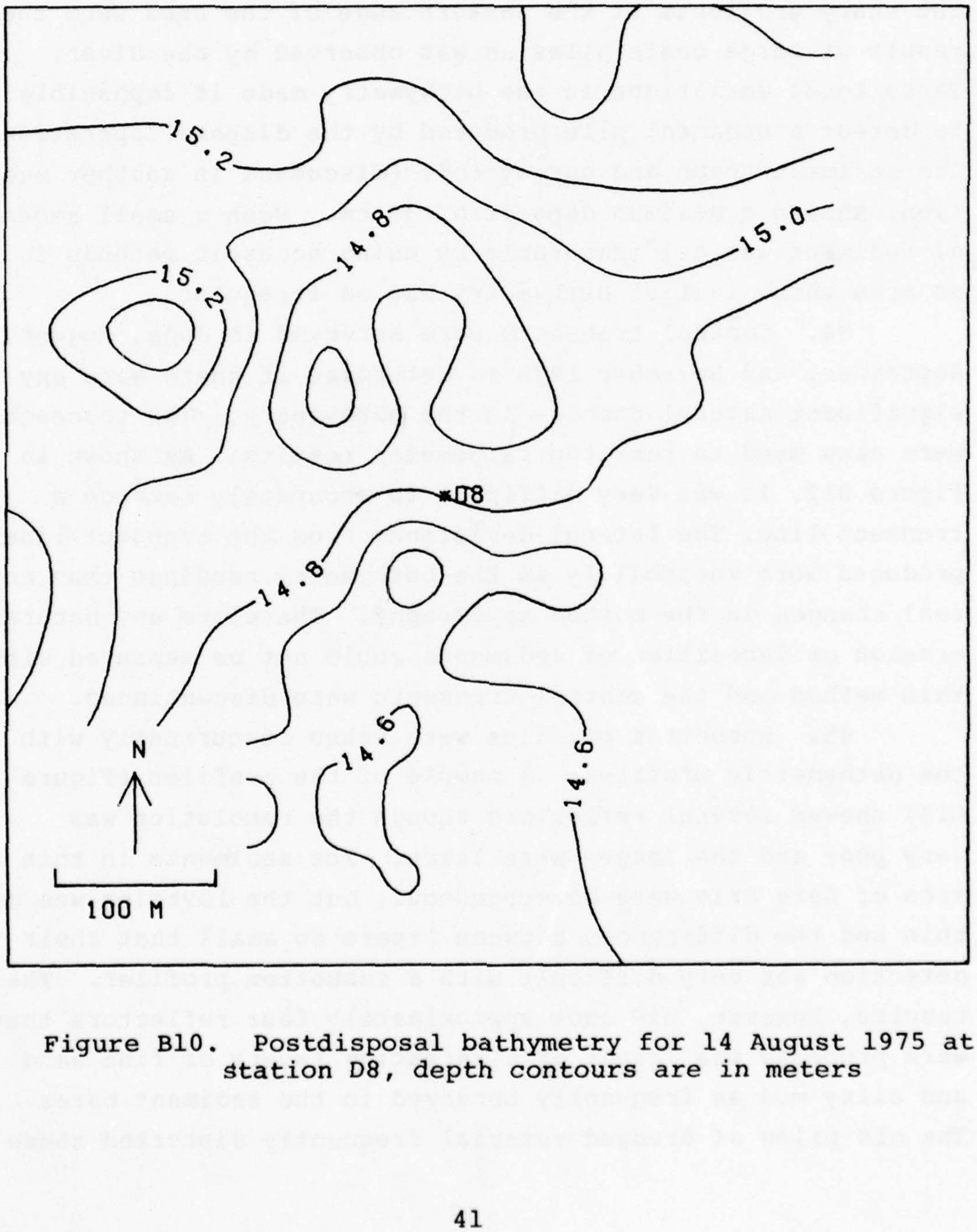


Figure B10. Postdisposal bathymetry for 14 August 1975 at station D8, depth contours are in meters

83. Detailed bathymetric surveys of site ND were also conducted before and after disposal operations. The predisposal survey taken on 14 May 1976 (Figure B11) showed that the center of the area was a very gently sloping region with numerous sediment piles from previous disposal operations. The sharp gradients at the eastern edge of the area were the result of large shale piles as was observed by the diver. These local variations in the bathymetry made it impossible to detect a sediment pile produced by the disposal operation. The sediment traps and survey rods (discussed in another section) showed a maximum deposit of 30 cm. Such a small amount of sediment was not measurable by using acoustic methods in an area whose initial bathymetry was so irregular.

84. Control transects were surveyed in June, August, September, and November 1975 to determine if there were any significant natural changes in the bathymetry. The transects were also used to test the fathometer results. As shown in Figure B12, it was very difficult to accurately retrace a transect line. The lateral deviations from the transect lines produced more variability in the bathymetry readings than any real changes in the bottom topography. Therefore any natural erosion or deposition of sediments could not be measured with this method and the control transects were discontinued.

85. Subbottom profiles were taken concurrently with the bathymetric profiles. A sample of the profiles (Figure B13) showed several reflectors though the resolution was very poor and the images were faint. The sediments in this area of Lake Erie were heterogeneous, but the layering was so thin and the differences between layers so small that their detection was very difficult with a subbottom profiler. The results, however, did show approximately four reflectors that were probably the result of alternating layers of fine sand and silty mud as frequently observed in the sediment cores. The old piles of dredged material frequently distorted these

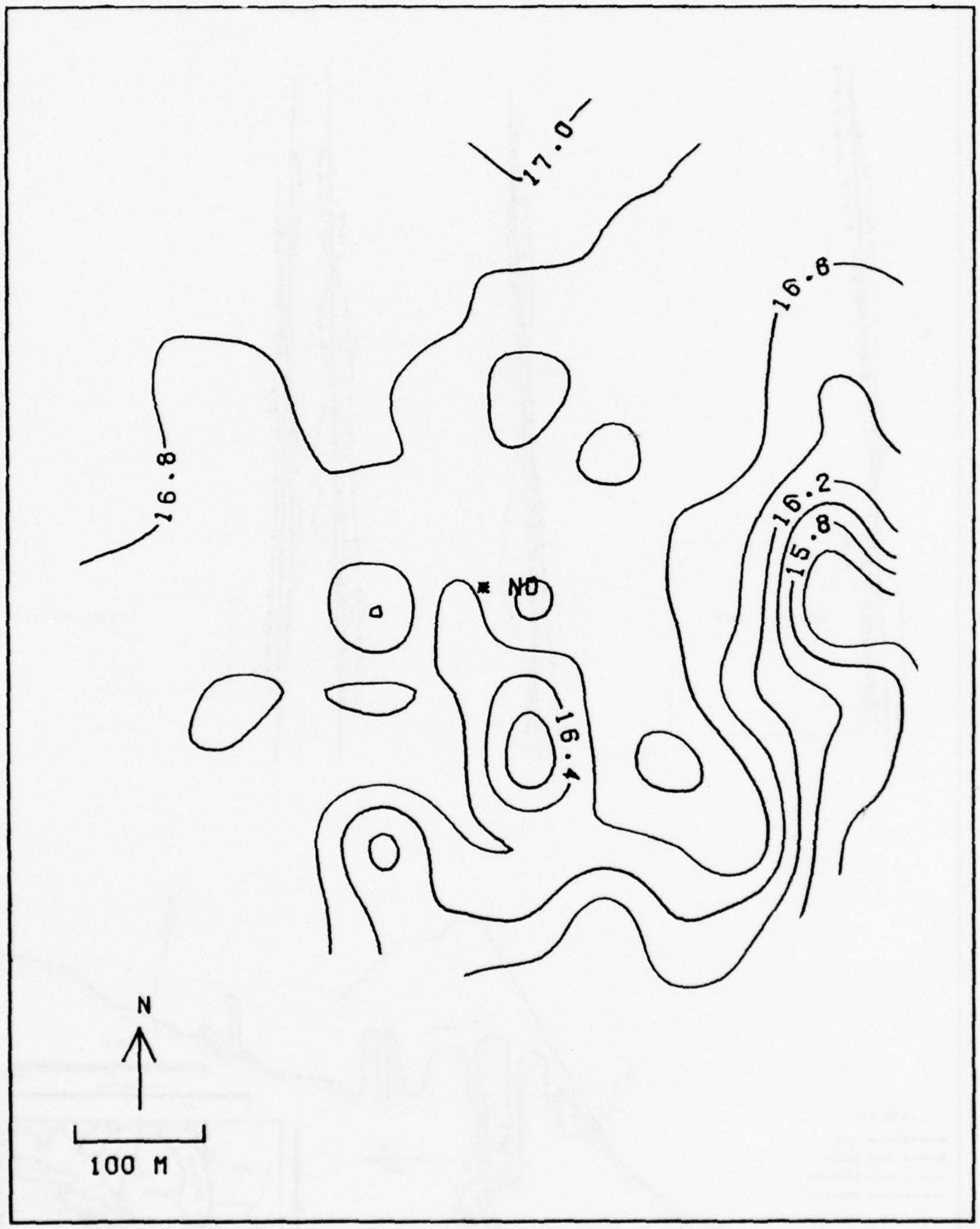


Figure B11. Detailed bathymetry for 14 May 1976 at station ND, depth contours are in meters

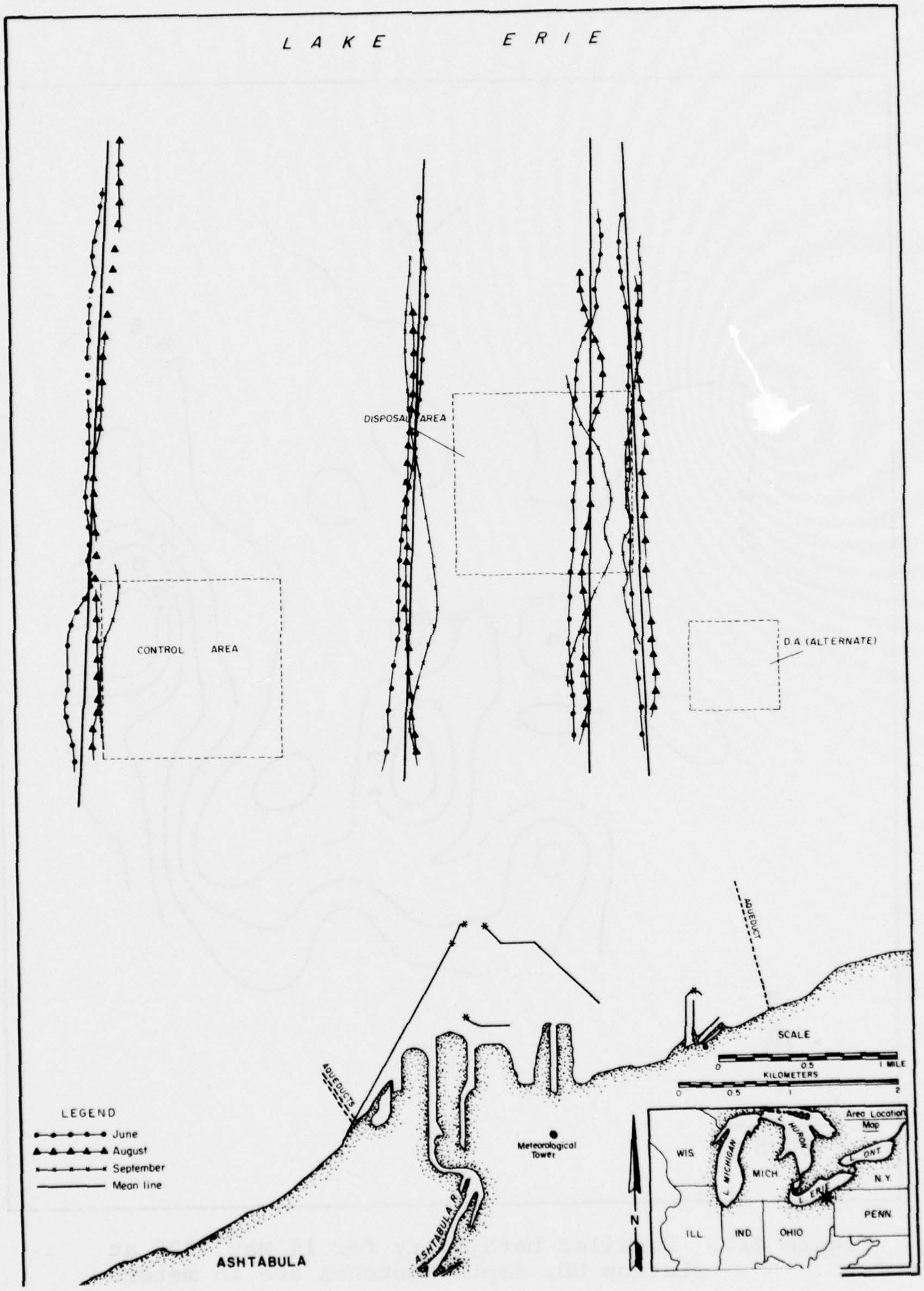


Figure B12. Control transects for June, August, and September 1975

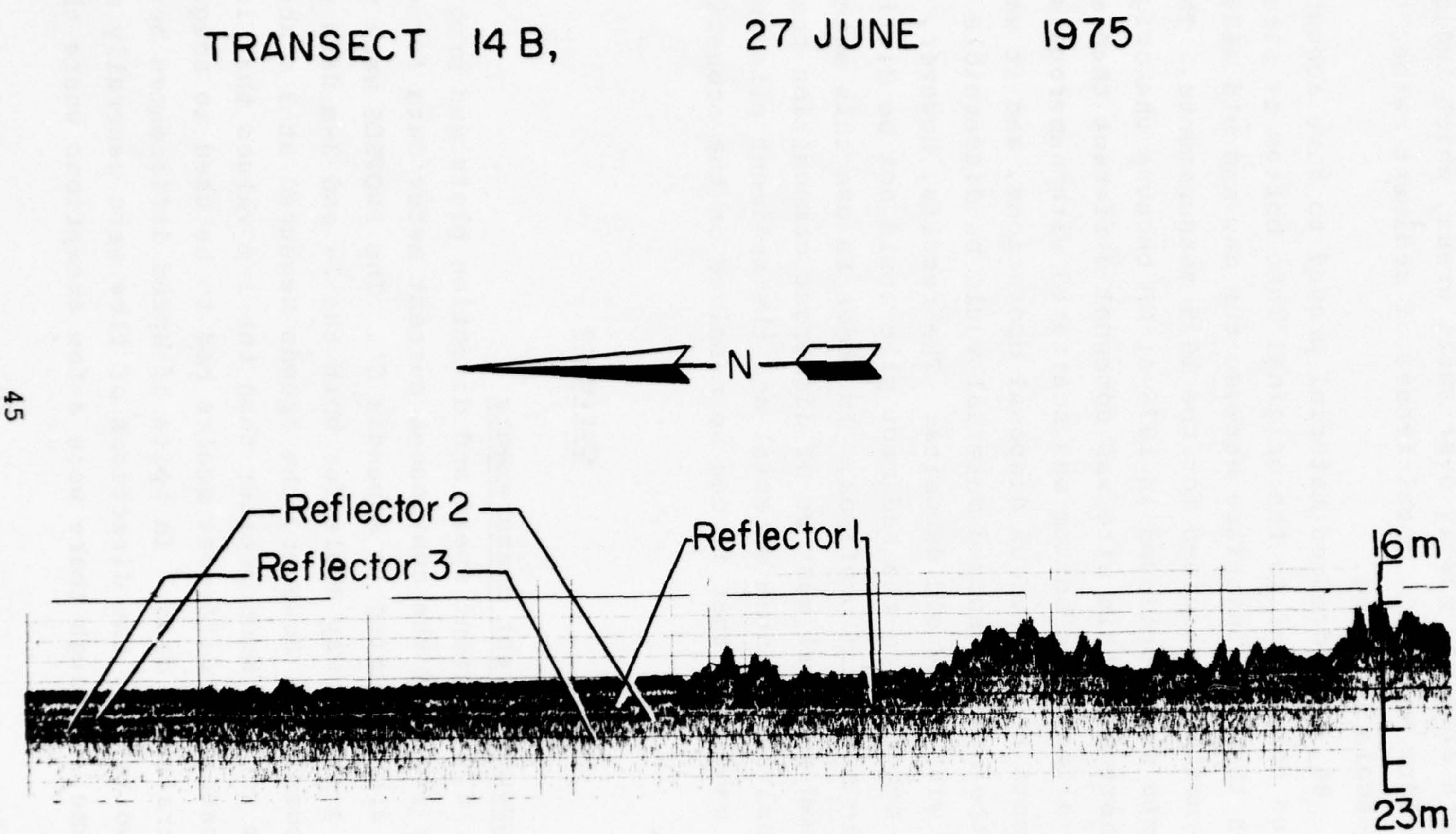


Figure B13. Section of subbottom profile showing mounds from previous disposal operations

reflectors, making it impossible to recognize them. The reflectors extended mostly over small areas, which indicates that there were only local lenses of sediment rather than large-scale layering.

86. The dredged material proved to have acoustic properties so similar to the original lake bottom at sites D2 and D8 that the interface between the new and old sediments could not be determined for the 1975 measurements. The measurements were continued in 1976 at ND because the original lake bottom at this site was somewhat different than at the other sites. The bottom was scattered with numerous shale fragments from previous disposal operations, and it was hoped that the newly disposed material would be discernible in contrast with these old deposits. The results, however, were again negative as the sediment pile could not be distinguished with subbottom profiles. In order to use this method, the disposed material must be of different composition than the original lake bottom material and the sediment pile must be large enough so that it can be resolved on the acoustic profile.

Currents

Continuous current measurements

87. Current speed and direction plots and progressive vector plots of the continuous current meter data for each month are presented in Appendix C'. The PROVECS were plotted using a single map scale for both the 1- and 3-m data whenever possible. However, the speeds measured at 3 m above the bottom were so much greater than the 1-m values that in several cases two different scales had to be used to adequately illustrate the data. In spite of speed differences between the two levels, the directions of flow were generally about the same, although there were a few exceptions where the

flows were in opposite directions (e.g., February 1976). The primary direction of flow was to the northeast with a secondary direction to the southwest.

88. The PROVECS were examined to locate periods of sudden changes in the current speed and direction, and the wind record was then examined in an attempt to explain these episodes. The examination of several of these events indicated that the wind was not the sole direct cause for changes in the currents at the disposal site. For example, near the end of August 1975, the currents at both levels moved to the northwest, but on the 30th the flow changed suddenly to the east with speeds reaching over 40 cm/sec. The wind during this period was generally out of the south with no sudden changes to explain the dramatic change in the currents. Another example occurred in July 1975 when the currents at the 3-m level moved to the east under southwest winds, but on 26 July the flow reversed direction even though there was only a small change in the wind field.

89. There were some events, however, that could be explained by changes in the local winds; for example, on 4 April 1976, the currents changed from easterly to westerly, which coincided with changes in the local wind. Even though a few such events seemed to be related to local wind changes, the results indicated that the currents at the disposal site were influenced more by other forces. The prevailing wind drives large-scale circulations in Lake Erie whose patterns are determined by the bathymetry, and possibly influenced by seiching, tides, and inertial motions. These large-scale currents determined the predominant flow measured at the disposal site. This conclusion seems most probable since local wind changes alone cannot account for the variability of the currents. In order to understand the mechanisms for the currents measured at a single point, data describing the existing circulation pattern in Lake Erie must be available.

90. The PROVECS and speed-direction plots were also examined to locate any periodic components in the flow field. The speed plots for the 3-m level for December 1975, January 1976, and February 1976 (Figures C'11, C'13, and C'15) showed very prominent oscillations with a period between 12 and 18 hr. The direction plot of June 1976 (Figure C'23) showed periodicity with the direction varying uniformly from 0 to 360 over a period of 18 hr. The corresponding PROVEC showed circular or cuspid motions that were characteristic of inertial currents (Mortimer 1971).

91. In order to determine the exact periods of the observed oscillation and to estimate the relative amounts of energy for each frequency, the directional components of the velocity field were spectral-analyzed. Samples of the results (Figure B14) showed that there were energy concentrations for periods between 12 and 18 hr. The largest and most consistent energy peaks were found at the 14-hr period, which was the first longitudinal seiche mode of Lake Erie, E_1 (Rockwell 1964). The lunar tide near 12 hr (M_1) was also prominent especially during unstratified seasons, while currents at the inertial frequency (f) were prominent during the stratified season. There was a small concentration of energy for the second seiche mode of Lake Erie (E_2) at 8 hr, though the peak was quite small and barely distinguishable from the background noise. These spectra also showed that most of the energy was in the east-west velocity component, which agreed with the PROVECS in that the currents were usually parallel to shore. The energy in the currents 1 m from the bottom was an order of magnitude less than at the 3-m level, and this agreed with the current speed plots.

92. Current speed persistence tables were constructed from the continuous current meter data and are presented in Appendix D'. Persistence values were useful in indicating the variability of the currents and also in locating episodes

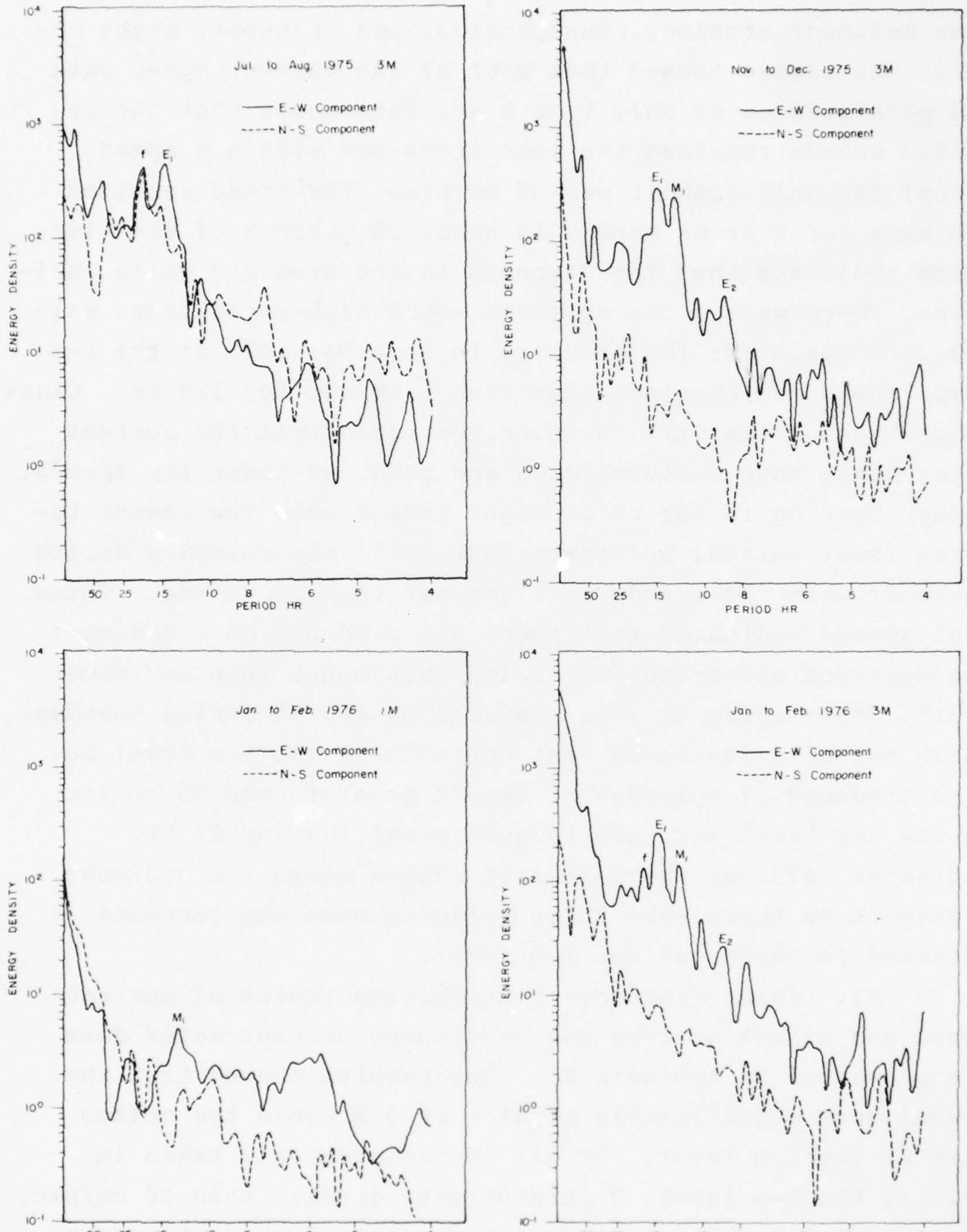


Figure B14. Power spectra of velocity components from permanent current meter data, energy density is given in cm^2/sec^2-hr

when sediment erosion, resuspension, and transport might occur. The tables showed that most of the current speed data had persistences of only 1 or 2 hr. This means that the recorded speeds remained the same (remained within a speed group) for only a short period of time. The speed remained the same for 5 hr or more only about 20 percent of the time, which indicates that the currents in the area are quite variable. There were a few episodes where high persistence values were computed; for example, in November 1975 at the 1-m level the speed remained less than 3 cm/sec for 123 hr. Close inspection of the data, however, revealed that the current meter might have malfunctioned and produced these low speeds. A poor bearing in the rotor might have biased the speeds towards lower values, but there were still six episodes during November when the speeds were greater than 26 cm/sec. These high speeds indicated that there was probably more sediment resuspension and transport during this month than any other month. These currents were produced by storms during November, which not only generated fast currents at the 1-m level but also produced 17 episodes of speeds greater than 26 cm/sec at the 3-m level with the longest event lasting 14 hr. September 1975 was the next most active month for sediment transport as there were three episodes when the currents exceeded 26 cm/sec at the 1-m level.

93. Joint frequency distribution tables of current speed and direction from the continuous current meter data are presented in Appendix E'. The results showed that the speeds were significantly greater at 3 m above the bottom than at the 1-m level. Of all the measurements taken in 1975 at the 3-m level, 7 percent were greater than 26 cm/sec, whereas at 1 m, only 1 percent were greater than 26 cm/sec. For the 1976 data at 3 m, 3 percent of the measurements were greater than 26 cm/sec, but at 1 m the speed never reached 26 cm/sec; in fact, only about 2 percent of the time was the

speed greater than 12 cm/sec. November was the most active month with speeds at the 3-m level exceeding 26 cm/sec more than 12 percent of the time.

94. The dominant direction of flow was generally shore-parallel. To better illustrate the direction of flow, current roses were developed from the distribution tables and are presented in Appendix F'. Monthly wind roses are presented in the same figure so that the wind direction can be compared with the corresponding currents. The predominant wind direction was out of the south-southwest although there was also a high percentage of occurrence out of the west. The currents at both levels were strongly affected by the bathymetry, which resulted in flows parallel to shore.

95. A monthly average speed plot was also developed from the joint frequency distribution data (Figure B15). This illustration gives the average monthly speed of the currents recorded at both the 1- and the 3-m levels as well as the average monthly wind speed. The monthly speed at the 3-m level varied from a high in November and December 1975 of 13 cm/sec to a low in April and May 1976 of only 5 cm/sec. The speeds at 1 m were less variable, fluctuating between 3 and 7 cm/sec. The increase in speeds at the 3-m level during November was in response to increased wind speeds and also due to unstable conditions produced by cold air flowing over warmer water. The drop in the current speed between February and March 1976, even though the wind speed was at its peak of over 5 m/sec, was caused by warmer air flowing over cold water. This situation produced a cold air layer at the water-air interface that greatly reduced the wind drag on the surface water. The current speed at the 3-m level increased again in August 1976 as the difference between the air and water temperatures decreased. As indicated above, the very low current speeds for the 1-m level during the period between September 1975 and February 1976 suggest that there

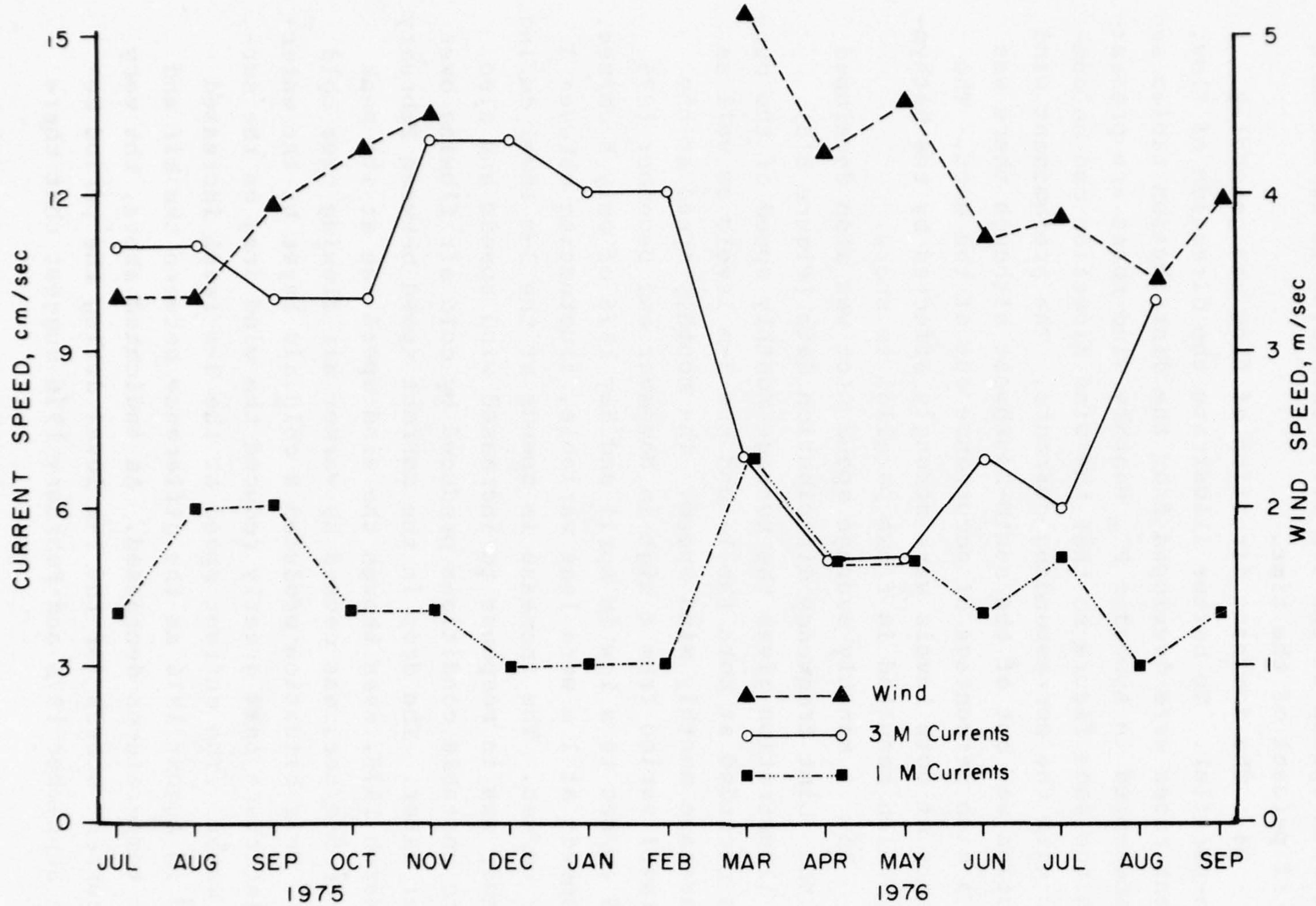


Figure B15. Monthly average current speed at 1 and 3 m and monthly average wind speed

might have been an instrument problem. With current speeds of the magnitude present at the 3-m level, higher speeds at the 1-m level should have been evident, especially during unstratified conditions.

Over-the-side current measurements

96. The recorded current speed and direction measured at each depth for each station are tabulated in Appendix G' (This appendix also contains the recorded transmissivity and water-temperature data which will be discussed in the following sections). In order to better illustrate the vertical variations in the horizontal velocity, plots of the current speed and direction as a function of depth were constructed and are presented in Appendix H'. The recorded current directions were quite variable especially when the current speed was low. Large current speed and direction fluctuations were frequently found to occur over as little as 1-m depth. In the presence of stratified conditions (June through September) such changes across the thermocline were reasonable; however, at depths above the thermocline such radical variations seemed unlikely. Some of the variability might have been caused by small movements of the vessel or wave motion.

97. The current data, however, did show several trends in the velocity distribution with depth. The speeds measured near the surface were generally higher due in part to the orbital velocity of the waves as well as the wind stress at the surface. The profiles generally showed a decrease in speed with depth although there were some exceptions. Several times the maximum speed occurred near the bottom. These erratic results made it impossible to determine a typical current speed profile, and thus any shear stress calculations would be invalid.

98. Since the current measurements were made at several locations in the study area at approximately the same time (within 5 hr), an estimation of the horizontal

variability of the velocity field could be made. The computed velocity vectors for each depth at each station were plotted on a base chart for each day of observation. The results (presented in Appendix I') showed, just as the vertical profile plots indicated, that there was considerable variability with depth at each station. However, if a single flow direction was estimated at each station by visually averaging the velocity vectors for each depth, then general flow patterns over the entire study area could occasionally be observed. For example on 1 August 1975 (Figure I'3) even though there were variations with depth, the average flow at all stations was to the southwest. Also on 16 November 1975 (Figure I'7), the results showed uniform flow to the southwest. At the same time, however, the nearshore measurements (TC6) indicated strong flow to the northeast. This reverse flow near the shore was probably caused by longshore currents that were deflected around the breakwall of the harbor. The Ashtabula River flow might have influenced the currents in that area although the river discharge for these periods was quite low.

99. Many of the measurements agreed with the observation that (whenever a pattern could be discerned) the flow was generally unidirectional over the entire study area except for occasional reversals of flow near shore. This supported the previous conclusion that the currents in the area were controlled primarily by the large-scale circulation in Lake Erie rather than the local wind patterns. There were, however, exceptions to this observation which indicated that at times there were small-scale variations in the currents (e.g., Figure I'12). There were also flow reversals with depth and large fluctuations in the speed which could influence the dispersion and transport of material during disposal operations.

Temperature Measurements

Continuous temperature measurements

100. The monthly continuous water temperature plots for both 1- and 3-m levels (above the bottom) are given in Appendix J'. The July 1975 plots showed that the thermocline had penetrated to within 3 m of bottom by 11 July. The large temperature fluctuations in the record between 11 and 15 July indicated that the thermograph was located near the thermocline and had detected oscillations of the interface caused by internal waves. By 15 July the thermocline had descended below the 3-m thermograph, and by 20 July it was less than 1 m from bottom. During August the depth of the thermocline fluctuated between the 1- and 3-m levels. By the first of September, the water had become isothermal at a temperature of about 22°C. The water then began to cool steadily at both the 1- and 3-m levels. The 3-m thermograph recorded erroneous temperatures that were approximately 5°C too high for the period between 15 October and 11 November 1975. This error, which is illustrated by a sharp discontinuity in November when the instrument was serviced, was probably caused by a split mercury column in the thermograph. Other than this discrepancy, the temperature decreased steadily from September 1975 until January 1976, when it stabilized at nearly 0°C.

101. Because of scheduling and instrument failure, no temperature data were collected between February and May 1976. The values recorded in July and August 1976 were similar to the 1975 values for these months in that large fluctuations in the readings were observed whenever the thermocline was located at nearly the same depth as the thermographs. These fluctuations had a period of about 14 hr, which was determined from the temperature record from August 1976 (Figure J'6). These oscillations were caused by internal waves traveling

on the thermocline and were probably generated by the first longitudinal seiche mode of Lake Erie, which has a period of 14 hr (Rockwell 1964).

Vertical temperature profile measurements

102. Vertical plots of the temperature profile measurements are presented in Appendix K' (station locations are shown in Figure B2). The July 1975 results showed a well-developed thermocline about 1 m above the bottom with a nearly isothermal epilimnion at about 24°C. The thermocline was prominent at all stations except TC6, which was located near the harbor entrance with only 12 m of water. The water column at this station was completly isothermal. By 1 August 1975, the surface temperature had increased to over 26°C, but there was still a well-defined thermocline about 1 m from the bottom. The thermocline was so well developed that there was as much as 11°C temperature drop over less than 1 m, and the interface was detectable on the fathometer traces. The sharp temperature gradient located at this depth agreed well with the results from the thermographs.

103. The temperature profiles changed very little through the middle of August 1975 but by the middle of September, the thermocline had disappeared leaving a single layer of water at a temperature of about 20°C. The temperature then decreased uniformly throughout the water column to 15°C by the middle of October and to 11°C by 16 November 1975.

104. No data were collected during the winter months. In March 1976, the entire water column was at the maximum density temperature of about 4°C. The temperature increased through April and May, but no stratification was apparent until a weak thermocline began to develop in June. The winds kept the water column well mixed, however, and no stratification was apparent in July even though the water temperature had increased to 22°C. No data were collected in August 1976, but in September there was a thermocline within 1 m of the

bottom similar to the one observed in August 1975.

105. These measurements indicate that a significant temperature gradient generally develops near the bottom during the summer months. Such a gradient establishes a density barrier that limits the advection and resuspension of bottom material. It also produces a collection zone for settling material and may aid in keeping some of the disposed dredged material in suspension. It further provides a discontinuity layer across which considerable shear flow can exist, which may result in better dispersion of disposed material.

Transmissivity

106. Vertical profiles of transmissivity were made at the same stations as the temperature measurements and the results are presented in Appendix K'. The first transmissivity readings taken on 1 August 1975 (Figure K'2) revealed that the profile was quite similar to the vertical profile of the temperature. The values were relatively constant with a transmissivity of about 20 percent in the epilimnion, but at the thermocline, there was a sharp decrease to about 6 percent for the 1-m layer between the bottom and the thermocline. This increase in turbidity in the hypolimnion was associated with the density discontinuity produced by the thermocline. Resuspended sediments could not migrate through the thermocline because of the relatively large amount of energy required to overcome the density gradient. Only under storm conditions when there was sufficient energy to break down the thermocline could the resuspended sediments mix freely throughout the water column. Also the thermocline was natural collection zone for settling organic matter that greatly decreased the transmissivity.

107. The transmissivity generally increased with distance offshore with the surface values varying from 14

percent near the harbor (TC6) to 22 percent for the farthest station offshore (TC3). The shallowness of the water column that allowed for penetration of the wave energy for sediment resuspension as well as nearness to the breaker zone and longshore currents were probably the major causes for the decrease in transmissivity at station TC6. The Ashtabula River discharge was very low for this sampling period so it affected the transmissivity to only a limited extent. The harbor, however, was continually agitated by shipping activity, and diffusion of the turbid water to areas outside the harbor might have influenced the transmissivity in the nearshore zone.

108. The transmissivity increased in the middle of August 1975 to surface values as high as 39 percent although the nearshore station was still quite turbid. By the middle of September 1975, the values dropped sharply to less than 10 percent with the nearshore station displaying a transmissivity of less than 1 percent. This sampling interval followed a period of heavy rains and high river discharge that affected the values. The nearshore station was most affected by the increased river discharge, but it was difficult to tell if the other stations were affected by the river plume or just by the increased wave and current activity associated with the rainstorms.

109. The measurements in October 1975 showed that the transmissivity was uniform throughout the water column with values between 10 and 13 percent, but in November the readings at all stations dropped to zero. These measurements were taken 2 days after a storm on 14 November where wave heights reached 2 m and current speeds reached over 40 cm/sec which resuspended sediments. A similar rapid change in transmissivity was observed by the diver during the September 1976 sampling. He reported visibilities of between 2 and 3 m before a storm, but the visibility dropped to zero after the storm.

Such low transmissivity readings were also reported by Pinsak (1968).

110. The strong susceptibility of the transmissivity values to previous meteorological conditions makes it difficult to characterize the values by seasons since the time of sampling relative to the last storm greatly influenced the readings. As a general rule, though, the transmissivity was fairly uniform with depth during the unstratified seasons. Transmissivity decreased below the thermocline during thermally stratified seasons and dramatically decreased following storm conditions. Consequently, it is apparent that there was considerable natural variation in the transmissivity, and the changes were closely associated with a thermocline, storm activity, and water depth.

Waves

Wave-gauge observations

111. Waves were measured to determine the wave climate of the study area and to provide an estimate of the degree to which wave action affected sediment resuspension and transport. The wave gauge successfully recorded water-level fluctuations for 10 periods averaging about 21 days each with six sampling intervals of 10 min duration per day. The significant wave heights calculated for each sampling interval are tabulated in Appendix L' along with time of observation, wave period, maximum wave height, wind speed, and an estimation of the magnitude of the wave's orbital velocity near the bottom at the disposal site. The significant wave heights are also plotted in Appendix M'. The wave periods were generally between 4.5 and 6.5 sec, which is 1 or 2 sec higher than the values obtained by Liu and Kessenich (1975) on Lake Ontario.

112. The recorded wave periods were higher than expected because the shorter period waves could not be measured

with a pressure sensor located in such deep water. Short-period waves attenuated more rapidly with depth than longer period waves so the results were biased in favor of higher periods. The tabulated results were computed from the detectable pressure fluctuations in 17 m of water at the disposal site, which excluded the detection of waves with periods shorter than 3.5 sec. Therefore, care must be taken when examining the wave results because they are not an exact description of the actual water surface fluctuations, but rather a theoretical estimate.

113. The wave gauge was located in shallower water (9 m) during October and November 1975. The measured pressure fluctuations were larger than those measured in deeper water because there was less attenuation due to water depth. However, the wave heights computed from the pressure fluctions were comparable to those calculated from measurements taken in deeper water. Therefore all wave height values were assumed to be representative of the waves that were present at the disposal area.

114. The majority of the recorded waves were less than 1 m, which is typical for waves on the Great Lakes (Liu and Kessenich 1975). During storm conditions the significant wave heights frequently reached nearly 2 m with maximum waves greater than 2.5 m. The largest waves were measured during November 1975, which was a direct result of the higher wind speeds during that month. There were two storms in November, one on the 14th and one on the 30th. In both cases the hourly wind speeds averaged greater than 13 m/sec and waves of nearly 2 m were generated. There were also several other storms that produced large waves (e.g., on 24 September 1975, 19 May 1976, and 7 June 1976) and in most cases a gradual buildup of the wave field was observed. The waves typically increased for about 20 hr before they peaked either at or slightly after the peak of the storm. They then slowly

subsided with the passing of the storm.

115. The oscillatory water-particle motions of the waves usually diminished to less than 1 cm/sec at the bottom. This value increased considerably under storm conditions. During the storm of 14 November 1975, the magnitude of the orbital velocity at the bottom averaged over 10 cm/sec for a 24-hr period. On 1 December 1975, the speed reached 20 cm/sec for a short time. These motions were qualitatively confirmed by the diver who could easily feel the oscillatory motions at the bottom while diving during a period of 1.0- to 1.5-m waves.

116. The high speeds at the bottom due to waves did not occur very often, but they could be instrumental in resuspending sediments. The speeds were not great enough alone to resuspend the sediments, but when superimposed with the ambient currents, they could easily add enough energy for sediment resuspension. Assuming that an erosion velocity was 20 cm/sec, then a 10-cm/sec component from the wave field in conjunction with a 10-cm/sec current speed would provide sufficient energy for sediment resuspension. Of all the OV measurements made, 2 percent were greater than 10 cm/sec. However, during November, 8 percent of the measurements were greater than 10 cm/sec, which indicates that November might have been the most active month for sediment erosion.

Visual wave observations

117. Monthly histograms of observed wave directions for 1975 and 1976 are presented in Figures B16 and B17. Visual observations were made both west of the harbor (Walnut Blvd) and east of the harbor (Lake Road East). There were no obvious differences between the observations made at the two stations. The majority of the waves approached from the northwest and the west-northwest sectors. This was due mainly to the westerly winds producing waves that were refracted as they approached the shore. The refraction caused the eastward traveling waves to bend shoreward, which made them

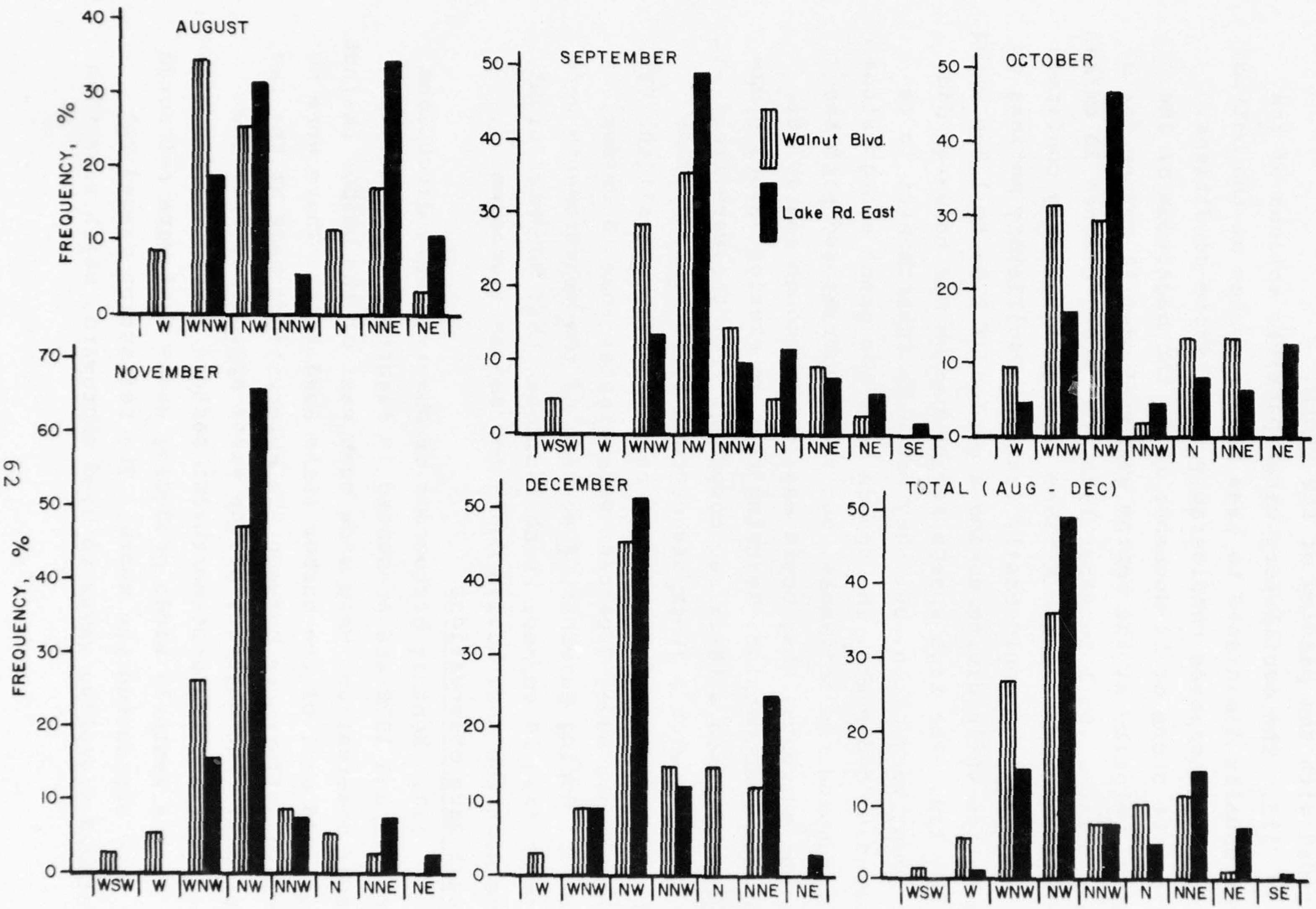


Figure B16. Histograms of wave directions observed from shore from August to December 1975

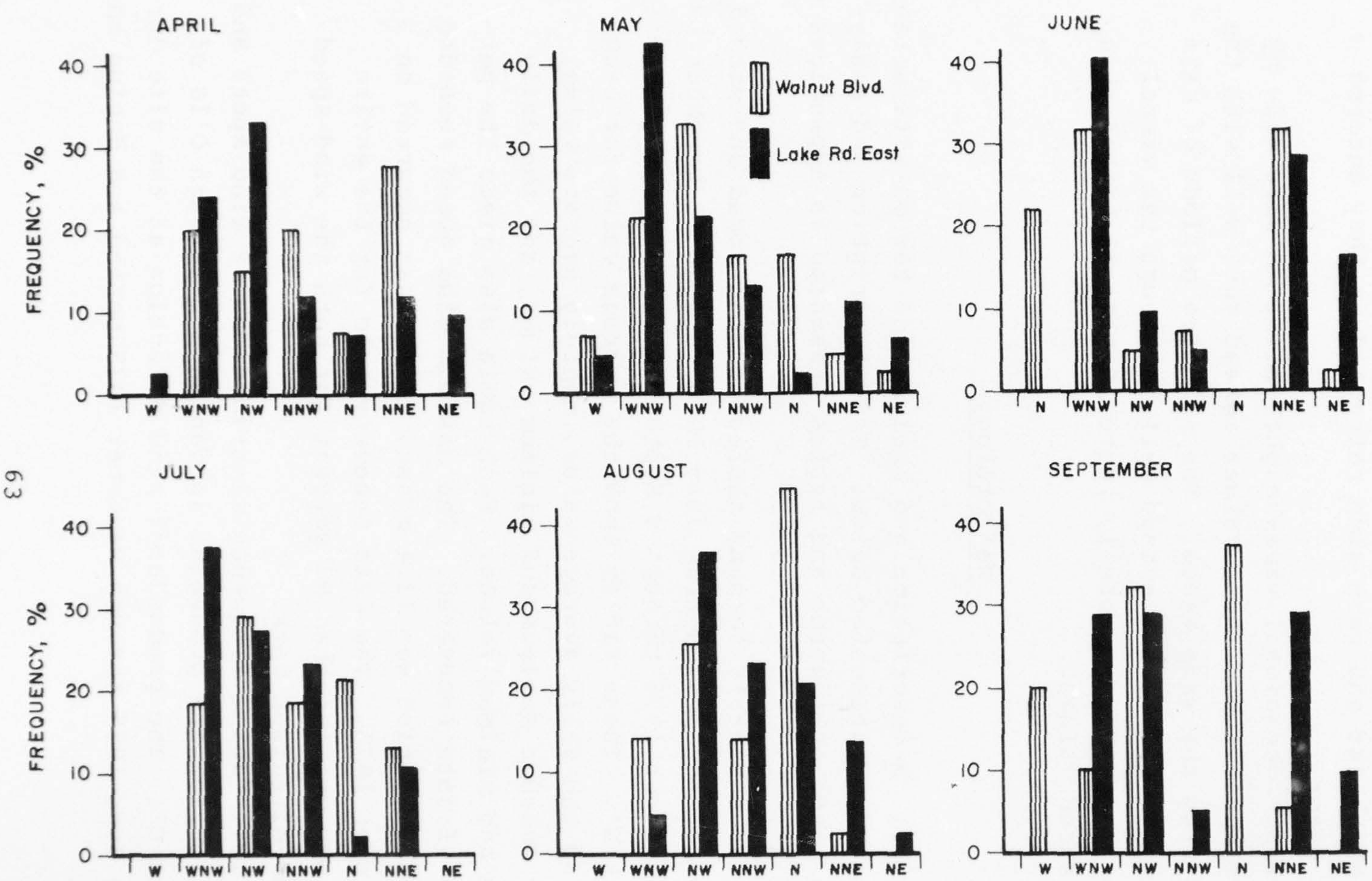


Figure B17. Histograms of wave directions observed from shore from April to September 1976

appear to come out of the northwest. Several of the monthly histograms showed a secondary concentration of waves out of the north-northeast. These waves were produced by winds out of the northeast and were also refracted as they entered shallow water.

118. Occasional wave-height estimates were made by the wave observers. These values agreed very well with the results from the wave gauge. The relative periods of calm and heavy wave activity agreed well, although the visual wave estimates were generally 10 to 20 percent higher than the measured values.

Meteorology

119. A description and analysis of the on-site meteorology data are presented below. This description and analysis are based on figures and tables presented in Appendices N' through R'.

120. Monthly summary tables of wind speed and wind direction for the period from July 1975 through 10 December 1975 and from March 1976 through 9 September 1976 are presented in Appendix N'. These tables show the average value for each hour plus the daily average value, monthly average value, monthly average maximum and minimum values, and the daily maximum and minimum values. Each table also gives the percentage of data recovered. The maximum wind speed recorded during this period was 13.4 m/sec, which last occurred on 10 November 1975. The data recovery rate for the entire period was greater than 90 percent for both the wind-speed and wind-direction data.

121. Joint frequency distributions of wind speed and wind direction are presented in Tables O'1 through O'16 of Appendix O'. The predominant wind direction at the site during the June 1975 through December 1975 period and during the

March 1976 through September 1976 period was from the south with a secondary flow from the west. The predominant wind speed class was the 1.8- to 3.6-m/sec class. Wind speed persistence data presented in Tables O'17 through O'32 of Appendix O' show that fifty percent of the hourly averaged wind speeds persisted for 2 hours or less and 90 percent persisted for 8 hours or less.

122. Monthly plots of wind speed and wind direction of hourly averaged data are presented in Appendix P'. These figures are graphical representations of the tables in Appendix N'. Appendix P' also includes figures showing the progressive movement of the wind during each month. It is evident from these figures as well as from the joint frequency distributions in Appendix O' that the general flow was toward the northeast during most months.

123. Time continuous air temperature data for the period from July 1975 through 10 December 1975 and from 24 March 1976 through 9 September 1976 are presented in Figures Q'1 through Q'4 of Appendix Q'. Monthly summary tables for this period are presented in Tables Q'1 through Q'13 of Appendix Q'. During this period a maximum temperature of 32.2°C occurred on 6 July 1975, and a minimum temperature of -6.7 C occurred on 7 December 1975. Over 90 percent of the temperature data were recovered during this period.

124. Time continuous solar-radiation plots for each month from 8 July 1975 through 14 September 1976 are presented in Figures R'1 through R'5 of Appendix R'. As expected the maximum solar radiation for the site occurred during July and the minimum occurred during December and January.

125. In general, the meteorological data collected on-site indicated that the site area was typical of a shoreline environment. This was evident from the fact that the range of temperature was not as great at Ashtabula as it was

at stations located farther inland. For example, during the period from July 1975 through June 1976 the daily maximum temperature value at Ashtabula (located about 1 km from the Lake Erie shoreline) averaged about 1.7° C cooler than at the Cleveland National Weather Service station. The daily minimum temperature at Ashtabula was 1.2° C warmer than at Cleveland.

Hydrology

126. Hourly lake-level values for periods when bathymetric surveys were conducted and daily average lake-level values for the entire period of the study are presented in Appendix S'. Since the study site was located approximately midway along the major axis of the lake, the water-level fluctuations were not as great as those typically observed at the eastern or western ends of the basin. The maximum recorded water level during the study period occurred in June 1976 and was 573.83 ft; the minimum was 570.02 ft and occurred in November 1975. The water level was lower during the winter months with January 1976 recording the lowest monthly mean level at 571.70 ft. The maximum monthly mean occurred in May 1976 with an average water level of 572.93 ft.

127. Ashtabula River discharge values and daily precipitation data are also presented in Appendix S'. The largest river discharge values occurred during the winter months due to melting snow and aquifer discharge, with the greatest rate of 3810 cfs occurring in February 1976. The greatest daily discharge of 812 cfs during the summer months occurred at the end of August 1975 following a heavy rainstorm.

128. Estimates of the total suspended sediments (TSS) discharged by the Ashtabula River were made using the river discharge values. Beginning in 1969, TSS values were measured by the USGS at a location 8 km upstream from the Ashtabula Harbor. However, measurements were discontinued by USGS in

1973. Therefore, direct measurements of TSS for 1975-76 were not available, and the values were estimated from a TSS-river discharge relationship. The TSS values from 1969 to 1973 (Table B2) were plotted against river discharge Q (Figure B18) and a curve was fitted to the data using the least-squares method. The relationship between TSS (tons/day) and the Ashtabula River discharge Q (cfs) was determined to be

$$TSS = 0.00104\ Q^{1.704} \tag{4}$$

This equation was then used to estimate the sediment loading of the river.

129. The estimated TSS values for the days when transmissivity measurements were taken are presented in Table B3. The TSS values for these days were extremely low with the maximum being only 2.37 tons/day. With such low values it was quite unlikely that the Ashtabula River affected the transmissivity at the disposal area.

Sedimentology

Survey rods and sediment traps

130. In 1975 graduated steel rods were placed at disposal sites D2 and D8 and at control site Cl. On 14 August, after dredging had ceased, no sediment accumulation was observed at Cl, but 45 and 37 cm of new sediment were found at D2 and D8, respectively. The rod at Cl was lost after this date, so no further control data were available. On 15 September a decrease in the height of these mounds of 5 cm at D2 and 3 cm at D8 was observed. The rod at D8 was lost in October, but the one at D2 showed 40 cm in October and only 30 cm on 11 November. A severe storm that occurred on 10 November might have eroded a portion of the sediment pile. Diver observations of the lake bottom at the disposal sites indicated a very silty bottom after disposal until

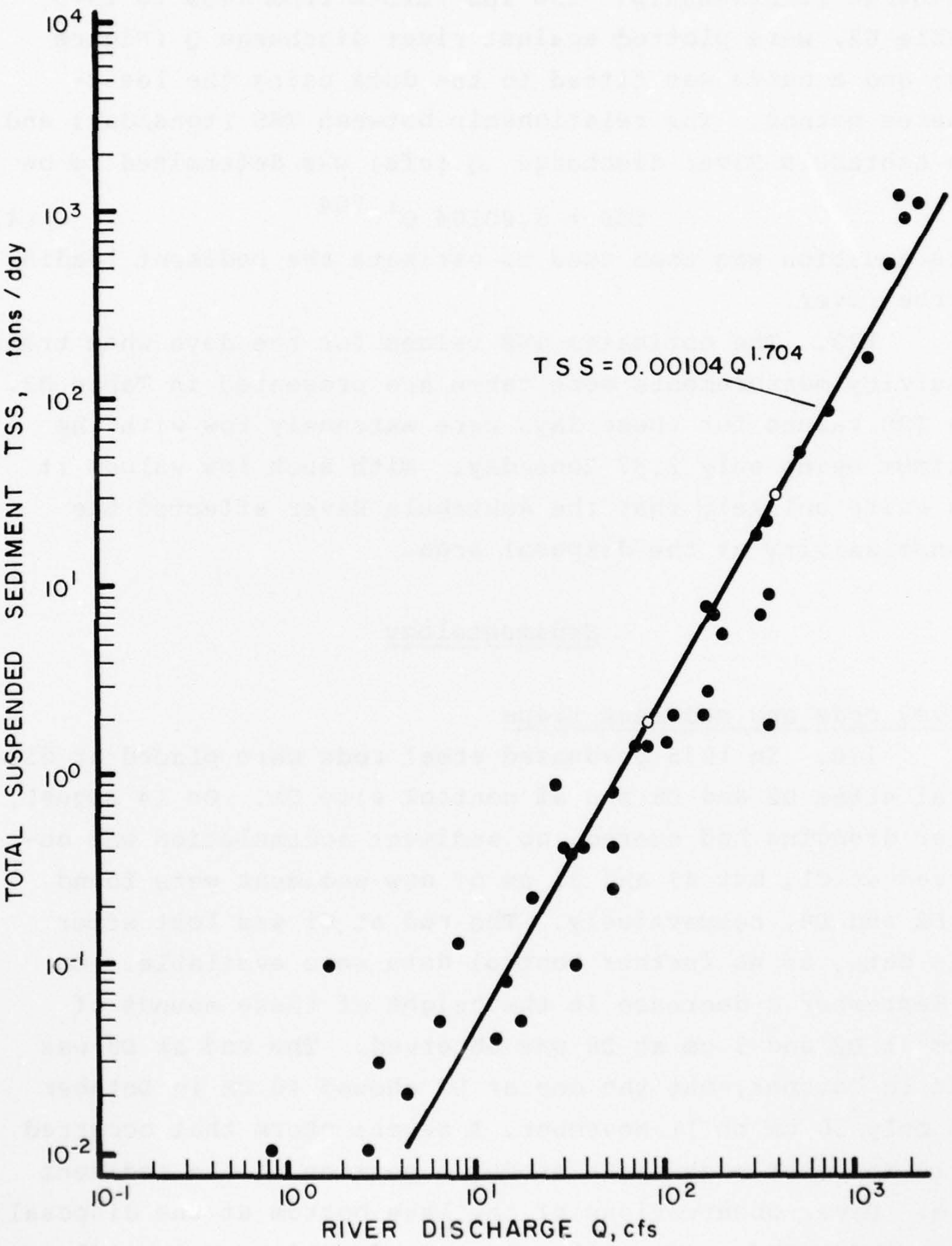


Figure B18. Sediment rating curve for the Ashtabula River based on USGS data from 1969 to 1973

November, at which time the bottom appeared to be more compact and slightly hummocky. This suggests that the November storm with its associated strong currents and wave activity had eroded nearly 10 cm of silty sediment from the pile at station D2.

131. Since the survey rods provided useful and reliable data for the 1975 disposal operation, a grid of 17 rods was established at ND prior to the 1976 disposal operation in order to monitor the sediment accumulation. Sediment traps were also placed at each survey rod location to provide supplemental data. The survey rod data for June 1976 (Figure B19) showed that a very flat, cone-shaped pile with a height of only 36 cm had been deposited near the center of the disposal area. The sediment trap data (Figure B20) showed similar results although the values were slightly less. The accumulated sediment values were integrated over the 160,000-m^2 grid area for both the survey rod data and the trap data in order to estimate the total volume of sediment. The results from the survey rods showed that approximately 18,000 m^3 had been deposited, and the trap data indicated that only about 14,000 m^3 of sediment had settled into the area within the 400-m square centered on the disposal site. Percent water content measurements of the sediment indicated that approximately 49 percent (by weight) of the sediment pile was water. Assuming a water density of 1.0 gm/cm^3 and sediment-particle density of 2.6 gm/cm^3 (quartz), the survey rod data indicate that 1.67×10^{10} gm of material fell into the study area. The records from the dredge HOFFMAN show that 2.41×10^{10} gm of material were discharged at the disposal site, which means that approximately 70 percent of the discharged material settled into the 160,000-m^2 area. The loss of material was due in part to rough weather that prevented the dredge from discharging the material directly over the designated site. The main reason, however, was probably the currents that

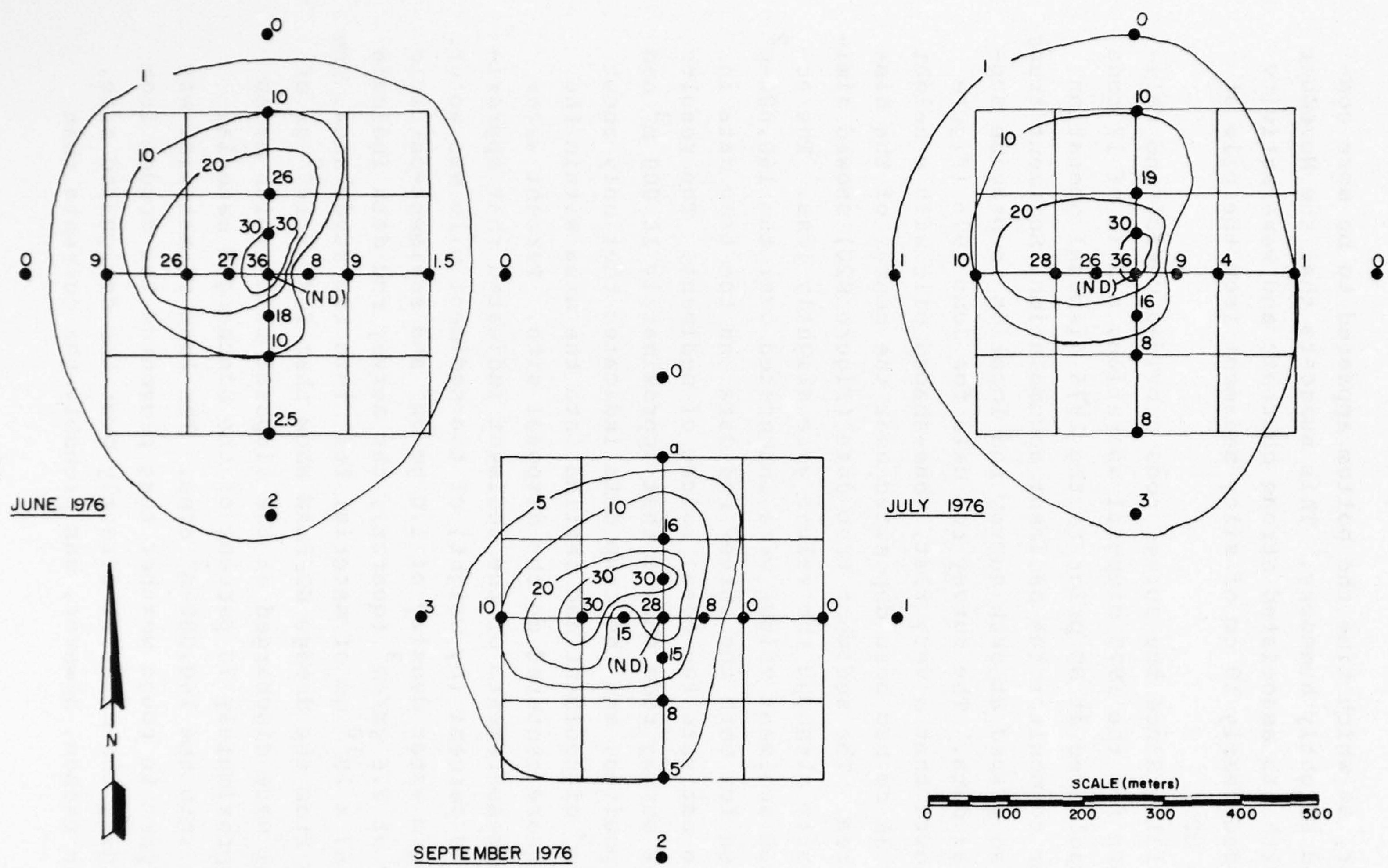


Figure B19. Isopleths (in centimeters) of sediment accumulation measured by survey rods. a = missing data

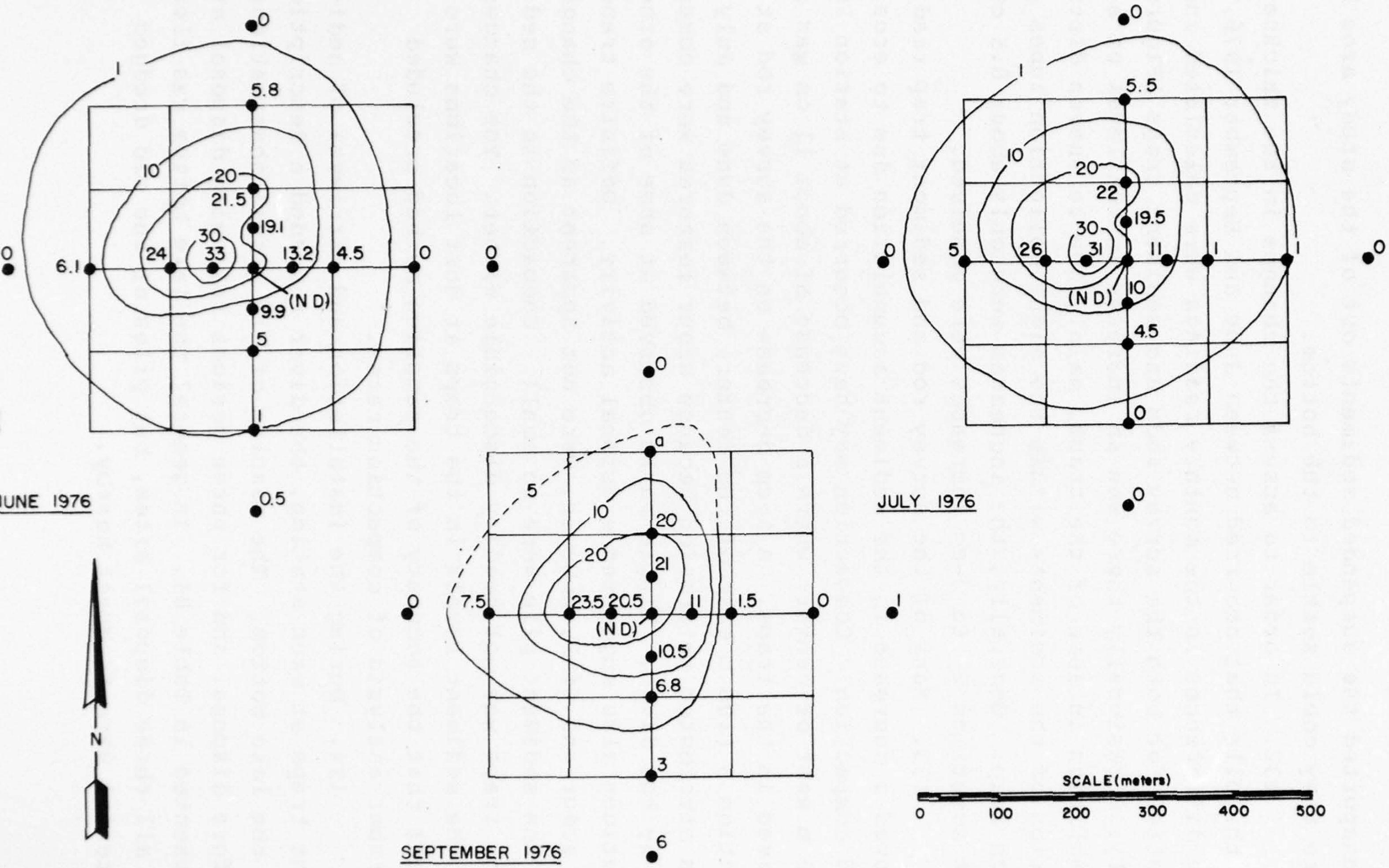


Figure B20. Isopleths (in centimeters) of sediment accumulation in sediment traps. a = missing data

transported the suspended sediments out of the study area before they could settle to the bottom.

132. In order to assess the changes in the thickness of the pile that occurred between June and September 1976, the differences in the monthly readings were calculated and plotted for both the survey rods and sediment traps (Figure B21). Occasionally there was an increase in the level of accumulation in some of the traps, mainly due to uneven distribution of the sediments within the eight collection tubes at each trap. Generally, the increases were only about 0.5 cm but sometimes 2- to 3-cm increases were observed.

133. Many of the survey rod and sediment trap readings showed a decrease in the sediment accumulation due to erosion and compaction. Compaction may have occurred at station 10 (50 m west of center) where a decrease of about 11 cm was observed in the traps. A 5-cm decrease on the survey rod at station 3 (100 m east of the center) between June and July was attributed to erosion because scour features were observed by the diver. Ripple marks observed at some of the other stations also suggested erosional activity. Definite trends of scour and fill, however, were not apparent as the changes in the sediment pile were so small. Compaction in the sediment traps was not readily discernible either. The changes in the sediment levels in the traps at most locations were so small that the accuracy of the sampling method precluded further analysis of compaction rates.

134. During the installation and retrieval of sediment traps at each station, the diver recorded a description of the lake bottom. The results of his visual observations before disposal and for three periods following disposal are presented in Table B4. In general the lake bottom was flat at all three disposal sites, but piles of the old dredged material were frequent nearby.

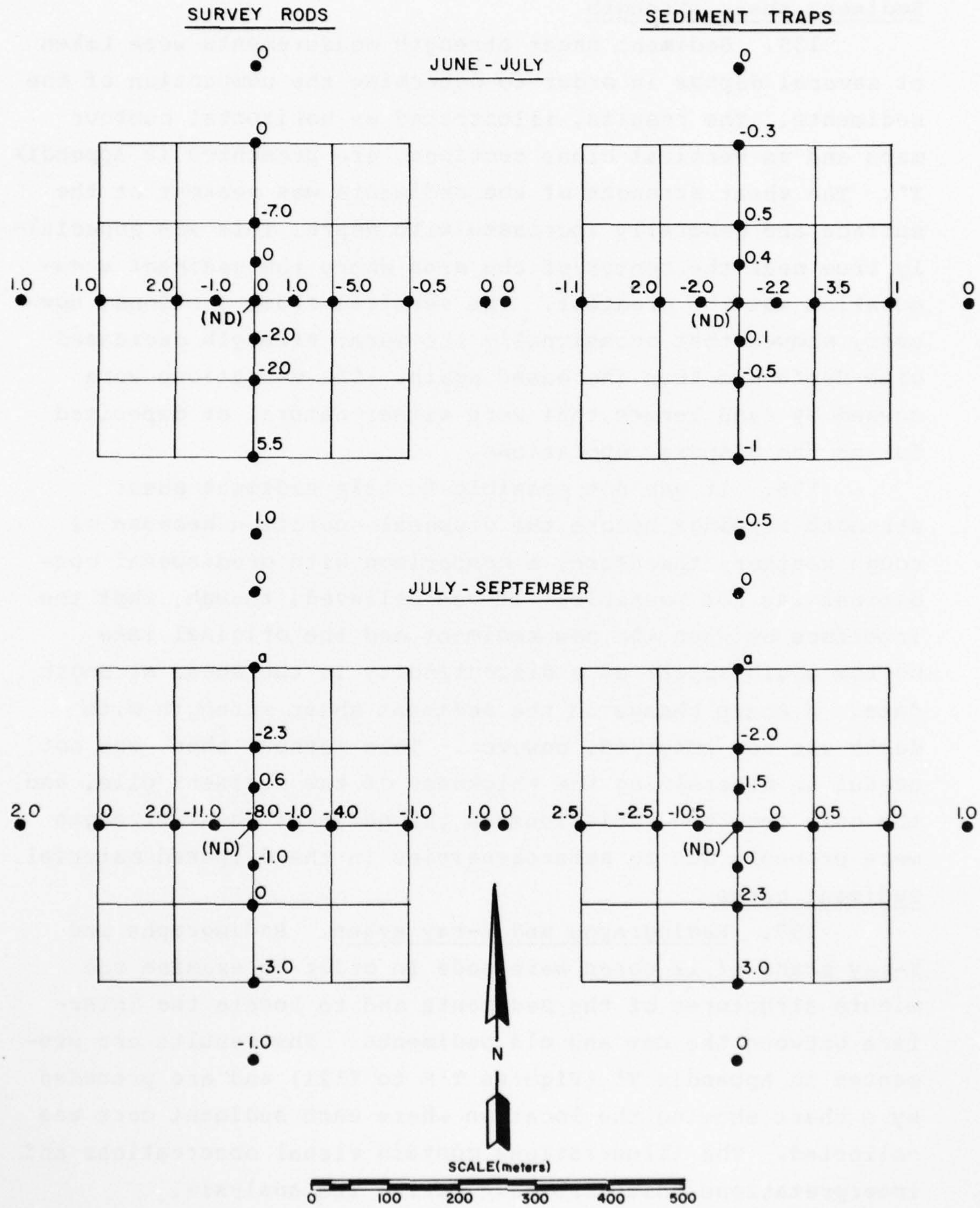


Figure B21. Relative changes of sediment accumulation depths (cm) between June, July, and September surveys

Sediment shear strength

135. Sediment shear strength measurements were taken at several depths in order to determine the compaction of the sediments. The results, illustrated as horizontal contour maps and as vertical cross sections, are presented in Appendix T'. The shear strength of the sediments was weakest at the surface and generally increased with depth. This was especially true near the center of the area where the sediment accumulation was the greatest. The vertical cross sections, however, showed that occasionally the shear strength decreased with depth and then increased again. The variations were caused by sand lenses that were either natural or deposited during the disposal operations.

136. It was not possible to take sediment shear strength readings before the disposal operation because of rough weather; therefore, a comparison with predisposal conditions was not possible. It was believed, though, that the interface between the new sediment and the original lake bottom would appear as a discontinuity in the shear strength data. A sharp change in the sediment shear strength with depth was not observed, however. This method, then, was not useful in determining the thickness of the sediment pile, and the only observed variations in the sediment shear strength were probably due to heterogeneities in the disposed material.

Sediment cores

137. Radiographs and X-ray scans. Radiographs and X-ray scans of 12 cores were made in order to examine the minute structures of the sediments and to locate the interface between the new and old sediments. The results are presented in Appendix T' (Figures T'9 to T'21) and are preceded by a chart showing the location where each sediment core was collected. The illustrations contain visual observations and interpretations that were made during the analysis.

138. The radiographs and X-ray scans showed the dis-

continuity between the original lake bottom and the dredged material. The amount of dredged material observed in the cores compared favorably with the amount measured with the sediment traps and survey rods. For example, in June, the survey rod showed 27 cm of sediment at location 10 and the radiograph of a sediment core taken at the same location showed about 23 cm of new sediment. In general, the measurements from the sediment cores were slightly less than the values obtained from the traps and rods. This was due, in part, to compaction that occurred when the cores were collected as well as additional settling during transport. Rhythmic deposits of sand and mud lenses were found in the bottom sediments, but they were not nearly as prevalent as in the dredged material. This was expected as the dredged material was deposited from several discharges, which produced graded bedding. This grading was evident in most of the cores where alternating rhythmic bands of sand layers with overlying mud were observed. The dredged material was clearly distinguishable from the original lake bottom sediments because of its high content of plant debris, cinders, coal fragments, and iron pellets, and because of density changes due to the cyclic deposition of the sediments.

139. Grain-size analysis. The grain-size distributions of samples taken from sediment cores were measured by Great Lakes Laboratory using the F.A.S.T. technique (Rukavina and Duncan 1970). Because of errors in the measurements, the sum of the constituents of the samples, in most cases, was not 100 percent. The largest discrepancies occurred in the 1975 data as 40 percent of the samples were off by more than 2 percent and 13 percent of the results were off by more than 5 percent. The largest discrepancies were approximately 8 percent. It was probable that the error occurred in estimating the silt fraction of the sample, so the silt fraction was adjusted such that the sum of the constituents was within

2 percent of the original sample weight. This was done on the worst cases as a test to see how this error would affect the results of the statistical analysis. No appreciable change in the results was obtained with such adjusted data for worst cases. Therefore, no further attempts were made to force the data, and the original data were used in all analyses.

140. Additional error may have been introduced in the measurement for the clay-sized particles. The samples were not wet sieved but rather oven dried, ground in a mortar and pestle, and then dry sieved and pipette analyzed. This method is not as accurate as wet sieving; however, no attempts were made to adjust the data and the results from this method are presented.

141. The grain-size distributions of the sediments, which were measured from sediment cores collected at the control sites and near the two disposal sites D2 and D8, were first plotted as weight percent versus grain size. Seven grain sizes were used in the analysis, and results (Appendix U') were based on the mean of four replicates. Any variability within the replicates was not investigated.

142. The results of the grain-size distributions showed that the sediments at the control sites were bimodally distributed (perhaps two overlapping normal distributions). The sediments consisted of about 45 percent silt, 45 percent sand, and 10 percent clay at all control sites. Only minor variations were observed in the distributions with both time and depth. Most of these variations were probably caused by sampling from slightly different sites as it was difficult to sample at exactly the same spot. The distribution curves for 1976 are different from those for 1975 because 11 grain sizes were analyzed in 1976 compared to 7 in 1975. However, the total percentages of sand, silt, and clay remained fairly constant at the control sites between 1975 and 1976.

143. The data collected near the harbor material disposal site D2 (stations D1 to D6) showed that there were some changes in the grain-size distributions following the disposal operation. There were no obvious trends in the variations of the distributions but rather apparently random changes. For example, at D1 and D2 there was an increase in fine sand, but at D3 there was generally a decrease in fine sand following the disposal operation. These results indicated that there were probably several local pockets of deposited sediments resulting from inhomogeneities in the dredged material that produced the variable results. Such variations were observed in the radiographs as well as visually in the sediment cores. There were also changes in the sediment distributions in the months following the disposal operation, but again no generalization could be made on the basis of the grain-size distribution plots.

144. The results of the grain-size distribution curves made from data collected near disposal site D8 (stations D7 to D12) were similar to the results obtained near site D2. There were frequent changes in the grain-size distributions following the disposal operation, but no trends in the variations were apparent except for a general increase in fine sand at most stations.

145. Since the grain-size distribution plots were ineffective in determining qualitative changes in the sediments other methods of analysis were used. The percentages of sand, silt, and clay from the surface sections of sediment cores were plotted on ternary diagrams. An example of the results (Figure B22) showed that a separation between the predisposal and postdisposal data collected at disposal site D2 was detectable. Most of the other plots for the disposal site data showed similar results with separate grouping of the predisposal and postdisposal values. The data from the control sites, however, showed only small changes in the predisposal

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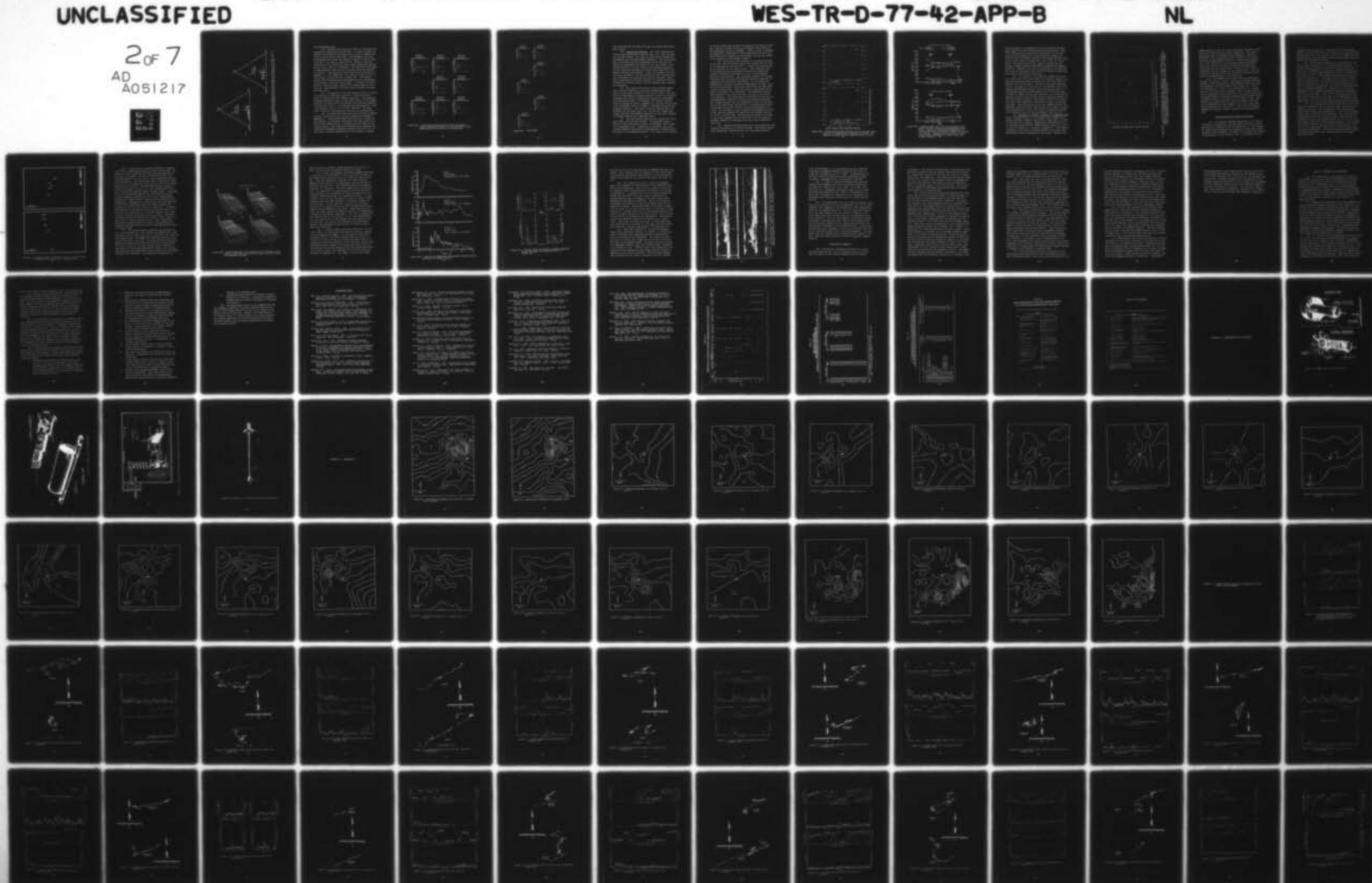

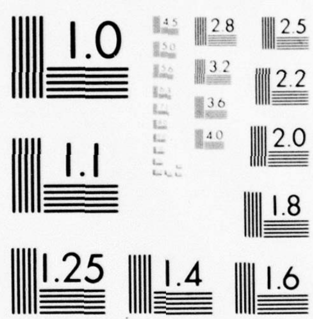

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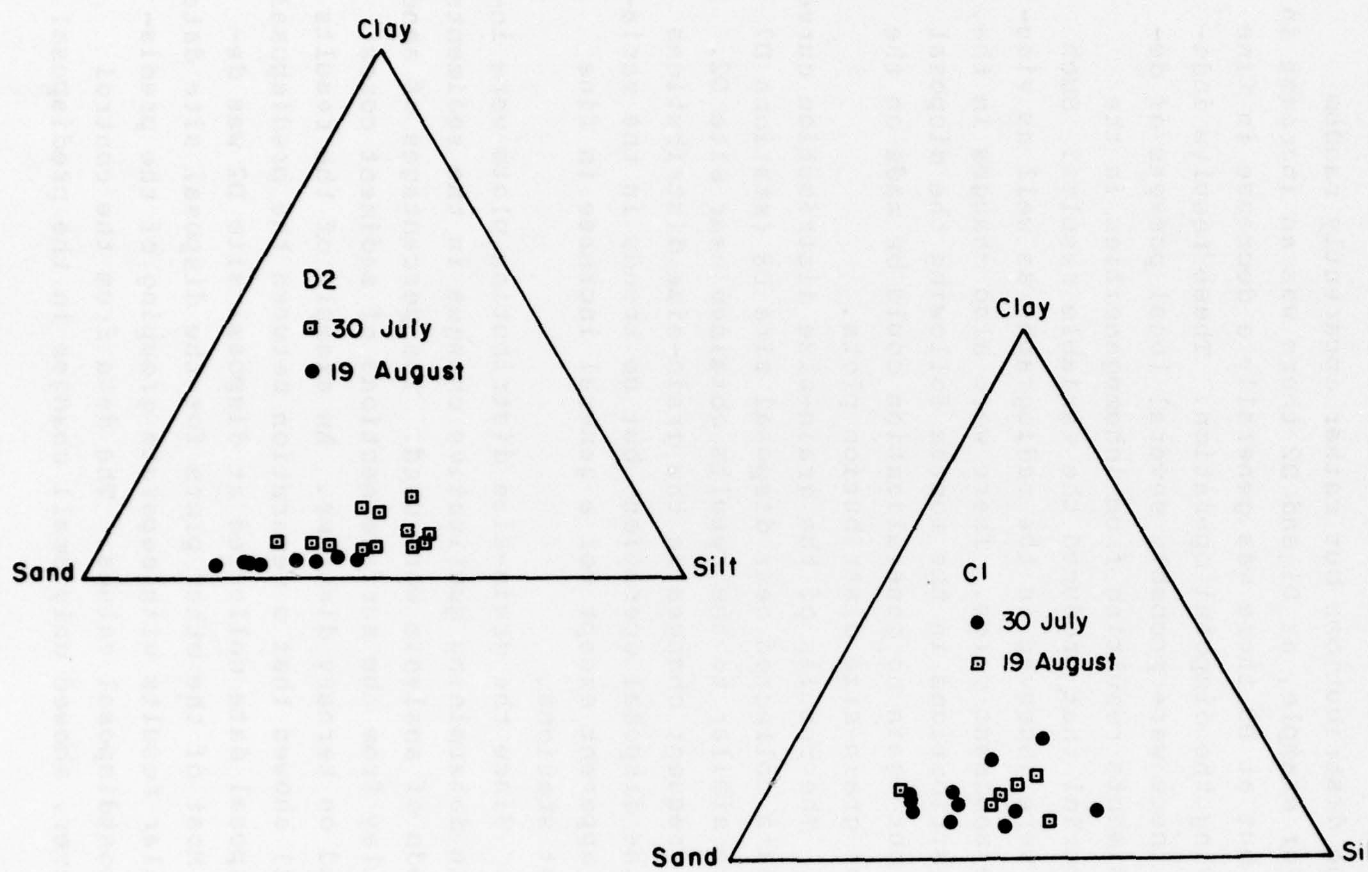


Figure B22. Ternary diagrams showing the distribution of sand, silt, and clay at control site C1 and disposal site D2, each point represents one replicate

and postdisposal data.

146. Sediment cores that were taken in 1976 were also analyzed for grain-size distribution. In order to study the sediment distribution with depth and in order to compare the control area with the study area, long sediment cores (approximately 50 cm long) were taken at station C3 and at trap locations 8, 10, and 12 located at ND. Based on the sedimentation rate for Lake Erie, these cores represented approximately 200 to 250 yr of sediments. The cores were sectioned at approximately 5-cm intervals, and the sediments analyzed for texture. The results of this analysis were included in Appendix U'. For comparison, the results of control site C3 and location 10 were plotted in Figure B23. The results showed that the grain-size distributions varied considerably at both sites, even over short depths. In general the sediments at station C3 had a higher silt content than at location 10. The sediments at ND were usually bimodal with more sand than silt.

147. In addition to the long sediment cores, a series of cores were periodically taken at 17 stations at ND in order to monitor the 1976 disposal operation. Two replicate sediment cores were taken at each station before the disposal operation (16 May) and at two periods following the disposal (10 June and 7 July). The sediments were analyzed for 11 phi sizes ranging from -1 to 9 at 1-phi intervals. The mean value of the two replicates was used for all calculations.

148. The grain-size data were first plotted as weight percent versus grain size, and the results are included in Appendix U'. These plots showed that there were changes in the sediment distributions throughout the study period with most of the changes being in variations of the sand or silt concentrations. The sizes most affected by the disposal operation and subsequent sediment transport were the -1 to 5-phi sizes. Further classification of the types of changes

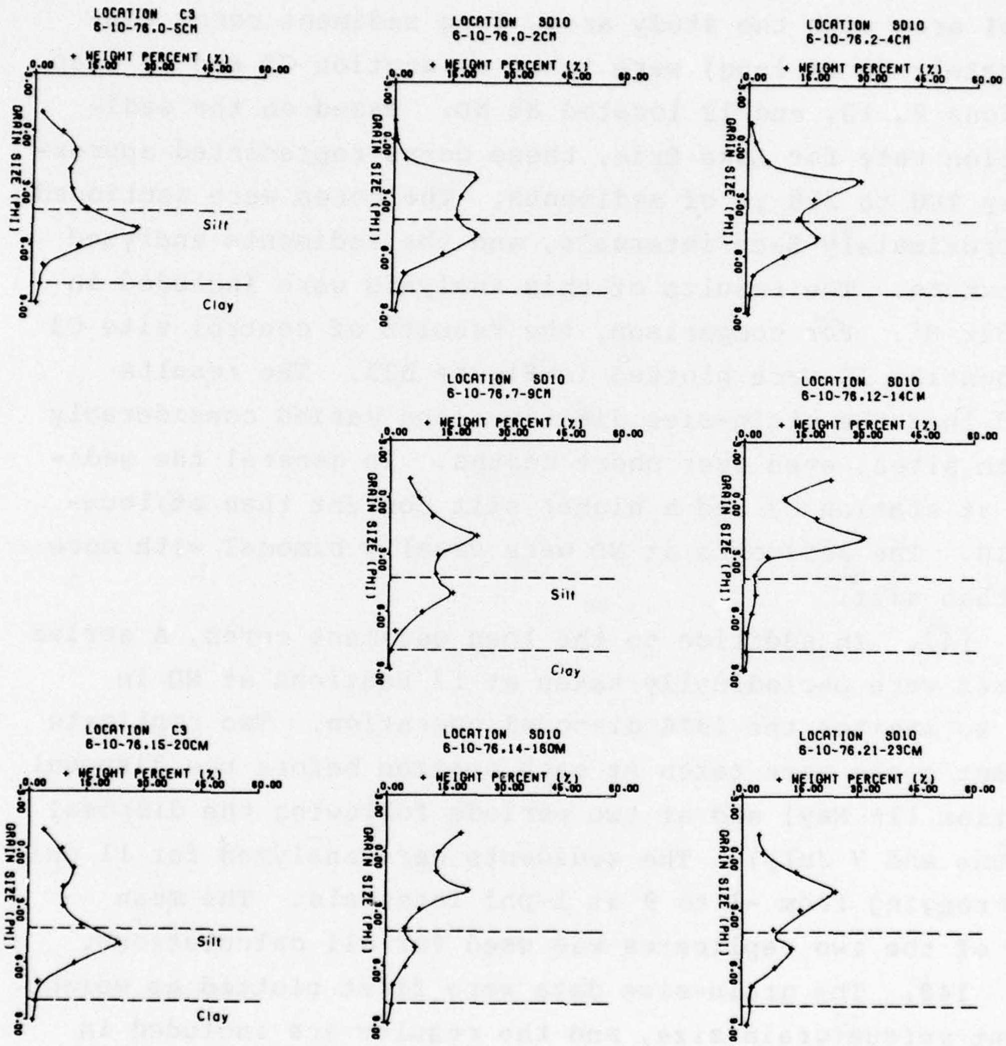


Figure B23. Grain-size distribution for several depths of cores collected at station C3 and location 10 (ND), determined from the mean of two replicates

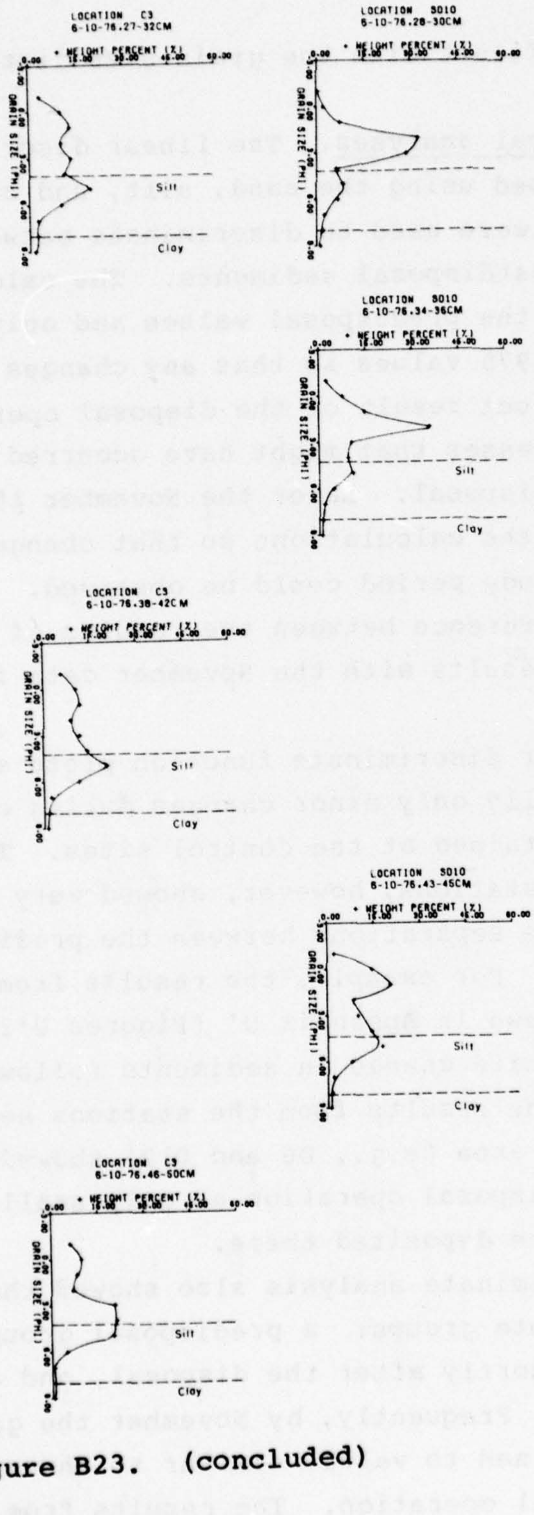


Figure B23. (concluded)

that occurred was difficult with the grain-size distribution plots alone.

149. Statistical analyses. The linear discriminate function plots developed using the sand, silt, and clay data for the 1975 samples were used to discriminate between the predisposal and the postdisposal sediments. The calculations were first made using the predisposal values and only the August and September 1975 values so that any changes in the results would be a direct result of the disposal operation and not erosional processes that might have occurred in the months following the disposal. Later the November 1975 data were also included in the calculations so that changes occurring throughout the study period could be observed. There was no appreciable difference between the results of the two analyses so only the results with the November data included are presented.

150. The linear discriminate function plots showed that there were generally only minor changes during each month in the values obtained at the control sites. The data from the experimental stations, however, showed very distinct groupings with definite separations between the predisposal and postdisposal data. For example, the results from stations D1 through D6 shown in Appendix U' (Figures U'28 through U'30) indicated a definite change in sediments following the disposal operation. The results from the stations near the perimeter of the study area (e.g., D6 and D12) showed less change following the disposal operation as only small amounts of dredged material were deposited there.

151. The discriminate analysis also showed that there were often three separate groups: a predisposal group, a group for data taken shortly after the disposal, and a group for the November data. Frequently, by November the grain-size distribution returned to values similar to those obtained prior to the disposal operation. The results from stations

D7 and D8 (Figure B24) showed the migration of groups as there was a distinct change following the disposal and a return to the predisposal values by November. Severe storms in November had apparently eroded some of the dredged material and eliminated much of the changes in the sediment distribution caused by the disposal of the dredged material.

152. The multivariate analysis of variance performed on the 1975 grain-size distribution data showed that the data at the experimental stations did not change in a similar manner as the data at the control sites. This indicated that the disposal operation produced statistically significant changes (significance probability < 0.05) in the sediment grain-size distribution. The univariate analysis of variance indicated that the clay-sized material was very important in producing the significant interaction. To illustrate the changes that occurred, the mean concentrations of sand, silt, and clay were plotted (Figure B25) along with the associated F-value probabilities. Each data point on the figure represents the average of 16 replicates. The November data were also plotted on the figure but were not used in the statistical analysis. The plots showed a large drop in the clay at the experimental stations following the disposal operation. This change accounts for the importance of clay in contributing to the significant interaction of the multivariate analysis between the control stations and the experimental stations. The decrease in clay is physically reasonable as much of the clay was probably stripped from the dredged material as it fell to the bottom. The plots also showed an increase in silt near disposal site D2 (stations D1 to D5) that was probably caused by discharging silt-rich harbor sediments in that area.

153. Scheffe contrasts were used to test where the significant interaction ($p = 0.05$) occurred. The results showed that significant interaction for the clay-sized particles

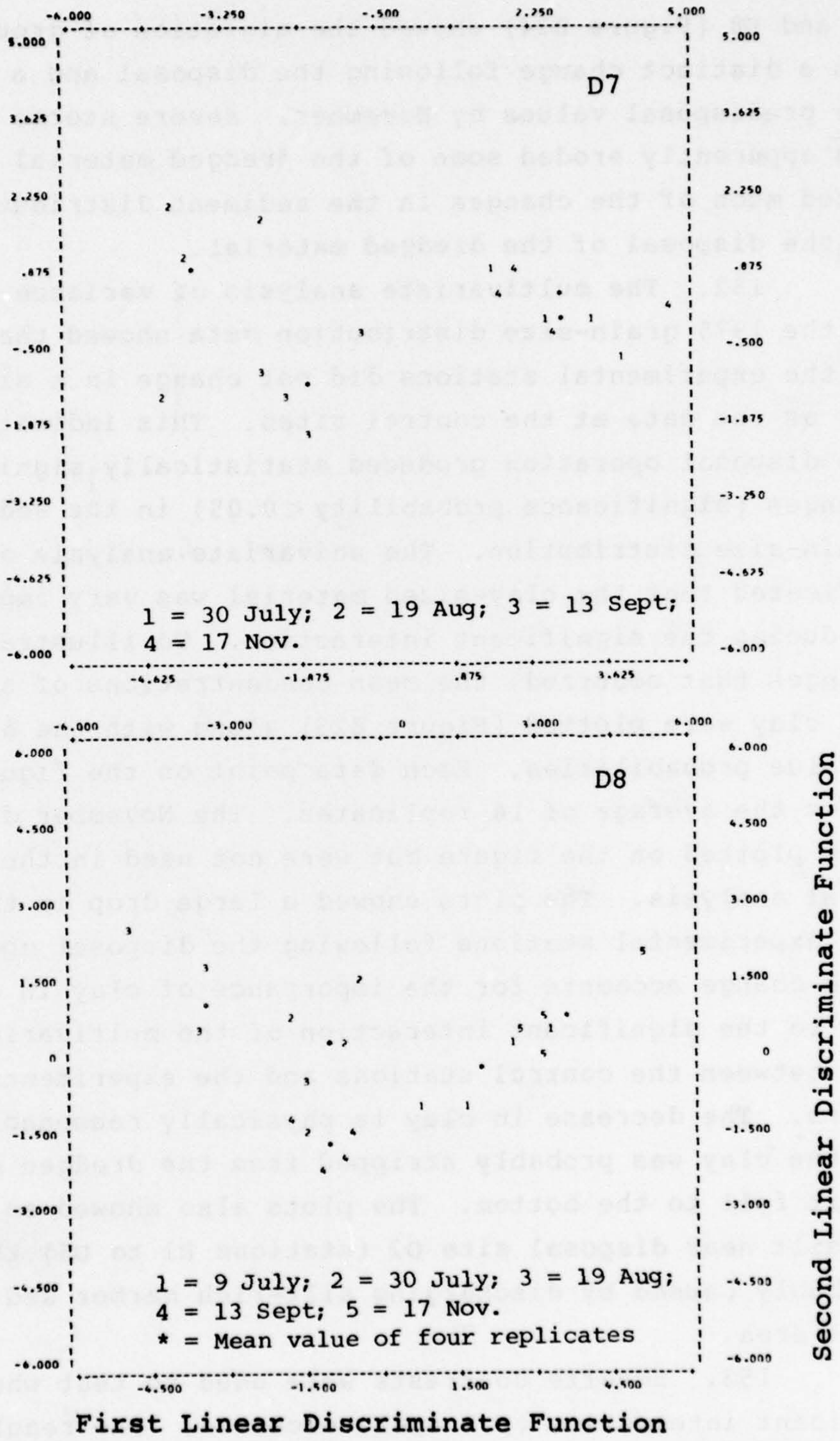


Figure B24. Linear discriminate function plots for sand, silt, and clay on experimental locations D7 and D8. The numbers correspond to the sampling dates in 1975

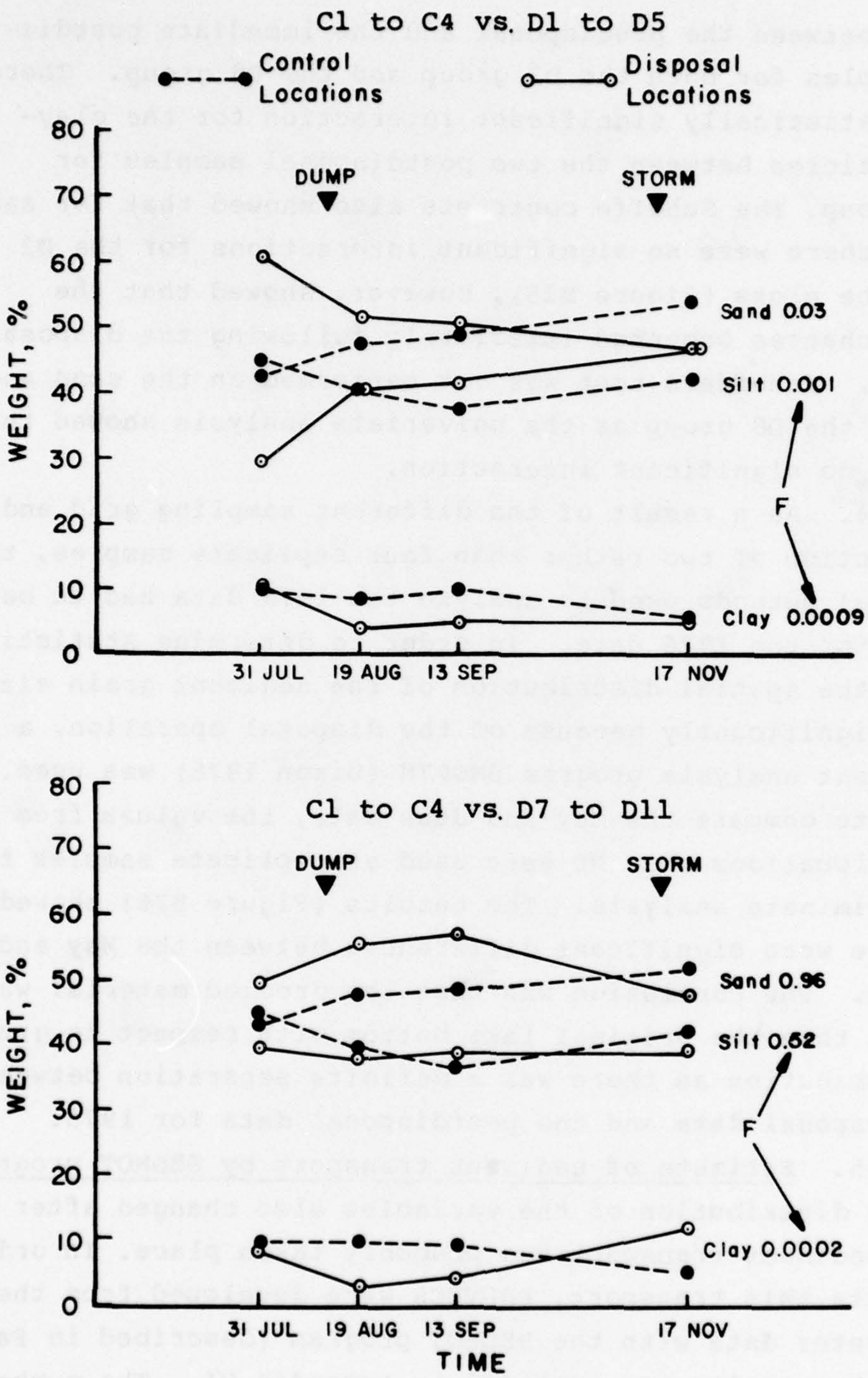


Figure B25. Average sand, silt, and clay concentrations versus time for control and experimental locations. Levels of significant probability of interaction based on univariate ANOVA are denoted by F-values. Significance of F-test of interaction based on MANOVA is 0.00001 (top) and 0.00002 (bottom)

occurred between the predisposal and the immediate postdisposal samples for both the D2 group and the D8 group. There was no statistically significant interaction for the clay-sized particles between the two postdisposal samples for either group. The Scheffe contrasts also showed that for sand and silt there were no significant interactions for the D2 group. The plots (Figure B25), however, showed that the greatest changes occurred immediately following the disposal operation. Scheffe's test was not performed on the sand and silt from the D8 group as the univariate analysis showed that there was no significant interaction.

154. As a result of the different sampling grid and the collection of two rather than four replicate samples, the statistical methods used to analyze the 1975 data had to be modified for the 1976 data. In order to determine statistically if the spatial distribution of the sediment grain size changed significantly because of the disposal operation, a discriminant analysis program BMDP7M (Dixon 1975) was used. In order to compare the May and June data, the values from 15 sampling locations near ND were used as replicate samples for the discriminate analysis. The results (Figure B26) showed that there were significant differences between the May and June data. The conclusion was that the dredged material was different than the original lake bottom with respect to grain-size distribution as there was a definite separation between the predisposal data and the postdisposal data for 1976.

155. Estimate of sediment transport by SEDMOT program. Since the distribution of the variables also changed after August, sediment transport had probably taken place. In order to estimate this transport, PROVECS were developed from the current-meter data with the SEDMOT program (described in Part II) and the results are included in Appendix V'. The numbers attached to the lines in the plots denote a particular time period when erosion theoretically took place. PROVECS from

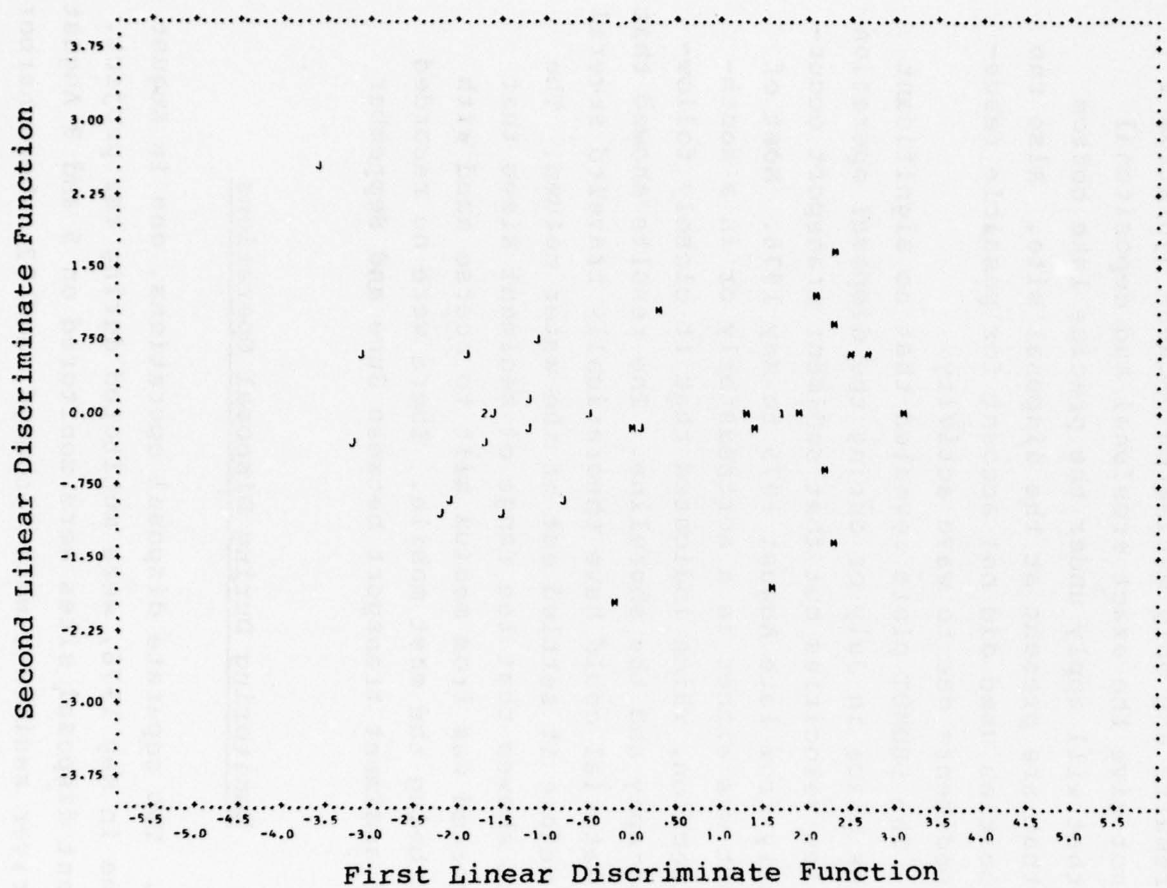


Figure B26. Plot from discriminate analysis conducted on 11 grain sizes showing separation of predisposal (M) and postdisposal (J) data. Linear discriminate functions show station locations for May and June data. Numbers 1 and 2 represent centroids of each group

SEDMOT denote how far and in what direction sediments of the given grain size could have been transported. The erosion velocities used for developing the PROVECS were based on Hjulstrom's curve (Hjulstrom 1939); therefore, the results gave only an approximate measure of erosion and transportation. The results are only estimates because Hjulstrom's curve does not give the exact erosional and depositonal velocities that will apply under the precise lake bottom conditions that are present at the disposal site. Also the erosion velocities used did not account for possible resuspension of sediments due to wave activity.

156. The SEDMOT plots revealed that no significant movement took place in July or during the disposal operation because of low velocities but that sediment transport occurred frequently from late August 1975 to May 1976. Most of the transport was either in a northeasterly or in a southwesterly direction, which indicated that it closely followed the topography and the shoreline. The results showed that the eroded material could have theoretically traveled several kilometers before it settled out of the water column. The results also showed that the range of sediment sizes that were transported was from medium silt to coarse sand with medium sand being the most mobile. There were no recorded episodes of sediment transport between June and September 1976.

Monitoring During Disposal Operations

157. Two separate disposal operations, one in August 1975 and one in May 1976, were monitored during the project. Two different disposal sites were monitored on 5 and 8 August: D8, where river sediments were disposed, and D2, where harbor sediments were discharged. In August, four vessels were anchored downcurrent of each disposal site to continously monitor

transmissivity (Figure B27). In addition to the anchored vessels, a moving vessel was used to follow the sediment plume. Navigational signal interruption caused by the DAMBACH and the dredge prevented accurate positioning and subsequent detailed plotting of the vessel's course.

158. Ambient water temperature, transmissivity, and currents were recorded prior to each disposal operation. The ambient water temperature on both 5 and 8 August 1975 was about 25°C (temperature profiles are included in Appendix K'). There was a well-developed thermocline at 13 m near D8 and at 16 m near D2 and C1. The temperature decreased to about 9°C below the thermocline. The transmissivity profiles showed that on 5 August prior to disposal there was about 25 to 45 percent transmissivity near the surface which decreased to about 15 percent at the bottom. The current meter data taken prior to disposal (Appendix W') showed that the flow was generally to the southwest although there was considerable variability with depth. Much of the variability might have been caused by motions of the boat as the measurements were being taken. Even with the variability the vertical profiles showed that the current speed generally decreased with depth.

159. The transmissivity data collected during the disposal were tabulated and the data for each station were subsequently plotted in three dimensions with transmissivity versus depth versus time (Appendix W'). Since each anchored vessel used a different transmissometer, the values were all standardized before the plots were made. This was done by arbitrarily setting the maximum value of each data set to 10 and adjusting the other values proportionately. This allowed for relative changes that occurred at each station to be observed, but comparison of the absolute values between stations was not possible. Values on the plots that lie between the actual data points were interpolated by the computer plotting routine.

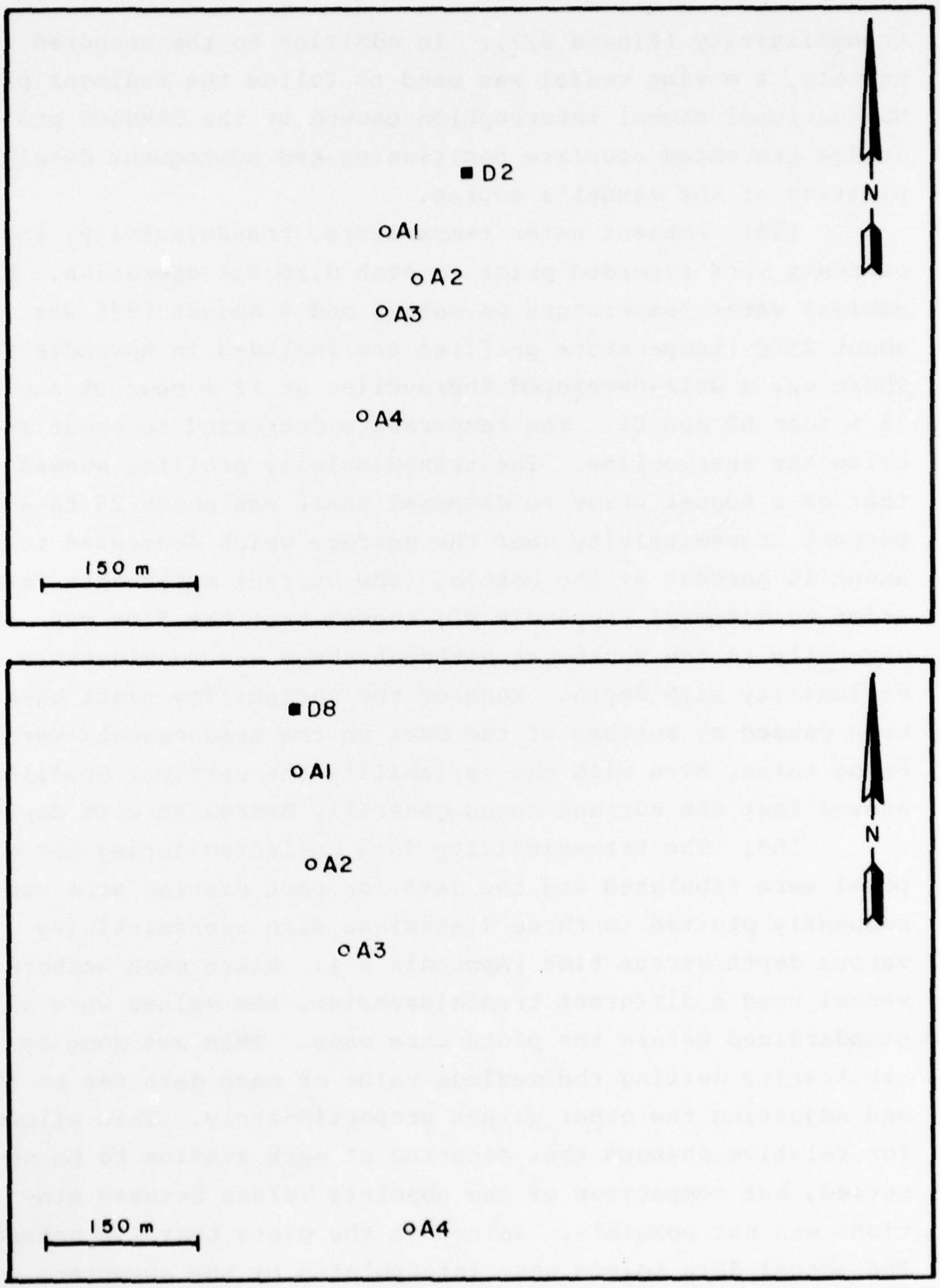


Figure B27. Anchored vessel locations relative to marker buoys at disposal sites D2 and D8, 5 August 1975

160. A typical set of profiles obtained at disposal site D8 on 5 August was plotted as shown in Figure B28. The values at time 0 represent the conditions approximately 10 min prior to disposal. The values plotted at time 10 are the measurements that were taken as the dredged material was being discharged. The figure shows that at station A1 there was a drop in transmissivity after about 10 min at all depths except near the surface. The greatest decrease, however, occurred at depths of 8 and 13 m, which implied that there were concentrated sediment plumes at these depths. The plume at 8 m may have been caused by the concentration of fine-grained sediments, whereas the plume at 13 m was probably produced by slightly heavier material that collected at the thermocline. Decreases in transmissivity were also measured at station A2, especially near the bottom, although the changes were not as pronounced as at station A1. No changes were observed at stations A3 and A4, which meant that the plume had not spread that far from the disposal site or had drifted in another direction with the currents. Generally the plume was only detected by the nearest vessel, which implied that it did not spread out over a very large area. Difficulty in positioning the vessels exactly downcurrent frequently allowed the plume to drift away undetected by the outlying stations.

161. The second disposal operation was monitored on 24, 25, and 26 May 1976. Two vessels, the DAMBACH and a boat from John Carroll University, were anchored near the center of the disposal site. The DAMBACH was tethered directly to the center buoy with a 20-m line. On 26 May current drogues were deployed to measure the speed and direction of the currents as an aid to position the John Carroll vessel downcurrent. The results of the drogue measurements showed very slow surface currents with considerably faster currents at 16-m depth flowing to the southwest. The background transmissivity

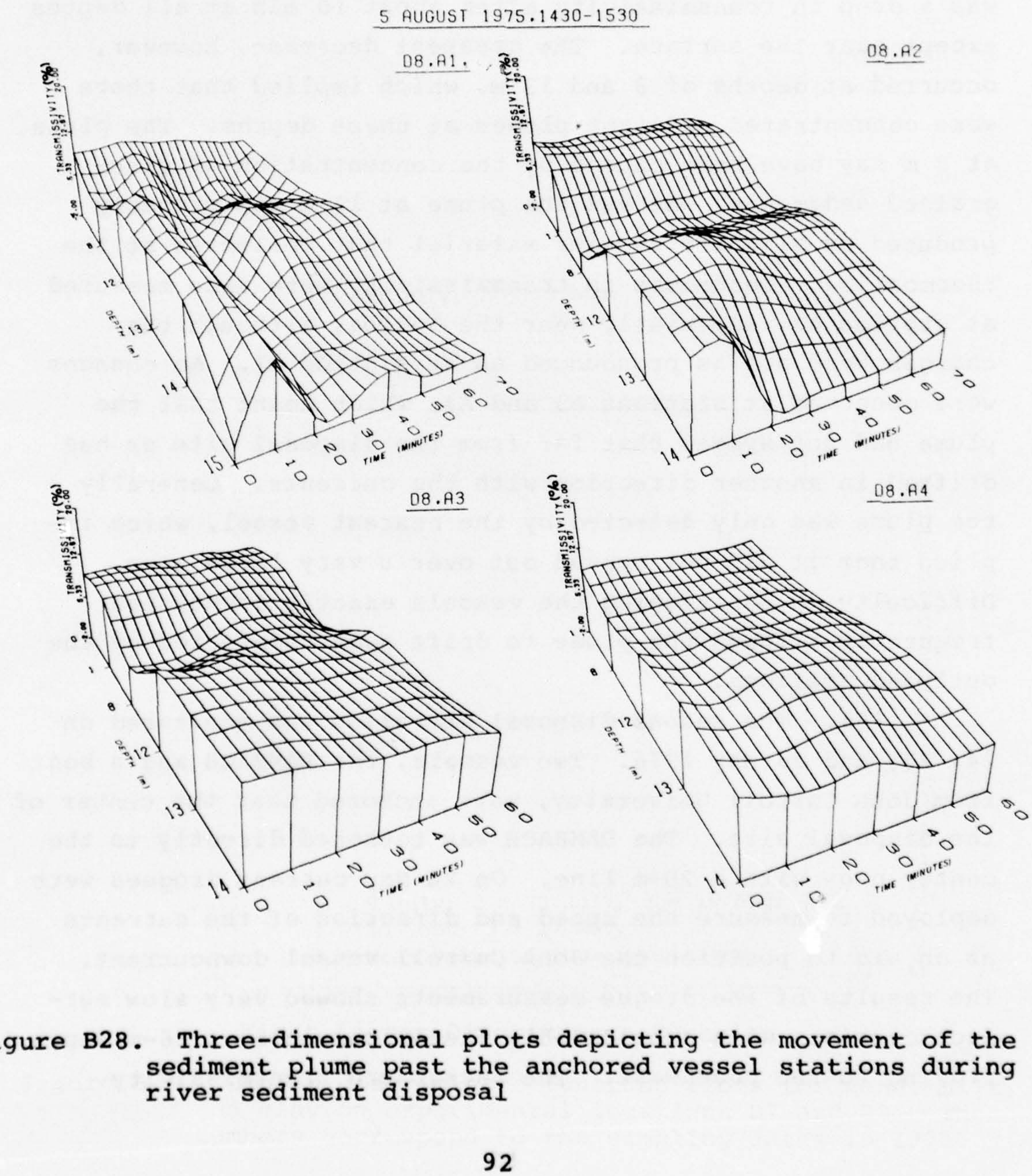


Figure B28. Three-dimensional plots depicting the movement of the sediment plume past the anchored vessel stations during river sediment disposal

measured prior to disposal showed generally low values of about 4 percent that increased slightly with depth.

162. During the disposal the dredge HOFFMAN discharged its material to the northwest of the buoy, which resulted in the dredge being typically about 70 m from the tethered vessel. Continous temperature readings were taken from the DAMBACH during several of the discharges and the results are presented in Figure B29. The descending material produced a temporary 2°C increase in the water temperature near the bottom. The temperature increased sharply and then either decreased steadily or decreased with large fluctuations as the turbulent plume spread past the temperature sensor. It took between 3 and 5 min for the plume to reach the sensor, which indicated that the plume traveled at a speed of between 20 and 40 cm/sec. It was difficult to make a more accurate estimate of the speed because the exact distance between the dredge and the DAMBACH was not known. Approximately 20 min after the plume reached the sampling station, the temperature returned to the ambient temperature. The rise in temperature was caused mainly by two factors: first, the disposed material was warmer since it was dredged from the shallower harbor and river and, second, the downwash of the descending material and subsequent mixing brought the warmer surface waters to the bottom.

163. A similar sudden change was observed in the currents, which were monitored simultaneously with the temperature from aboard the DAMBACH. As the plume reached the current-meter sensor, the current speed within the plume increased to values as high as 70 cm/sec that were usually accompanied by large fluctuations in the direction (Figure B30). The speed usually dropped to its background value within a few minutes, but in one instance large fluctuations persisted for 10 min or longer (the remainder of the current data are included in Appendix W'). The impact on the current speed

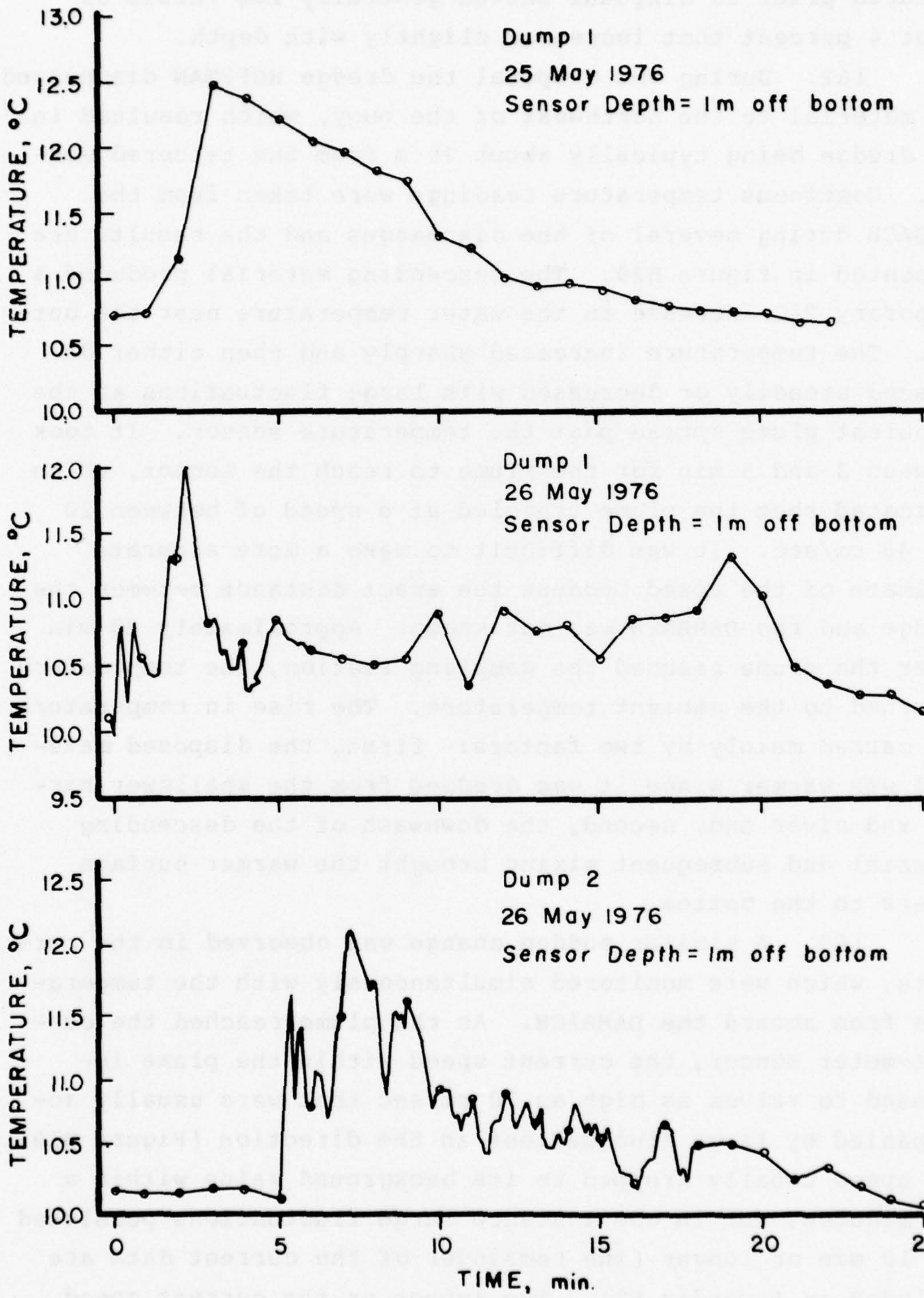


Figure B29. Continuous temperature measurements obtained during discharge of dredged material

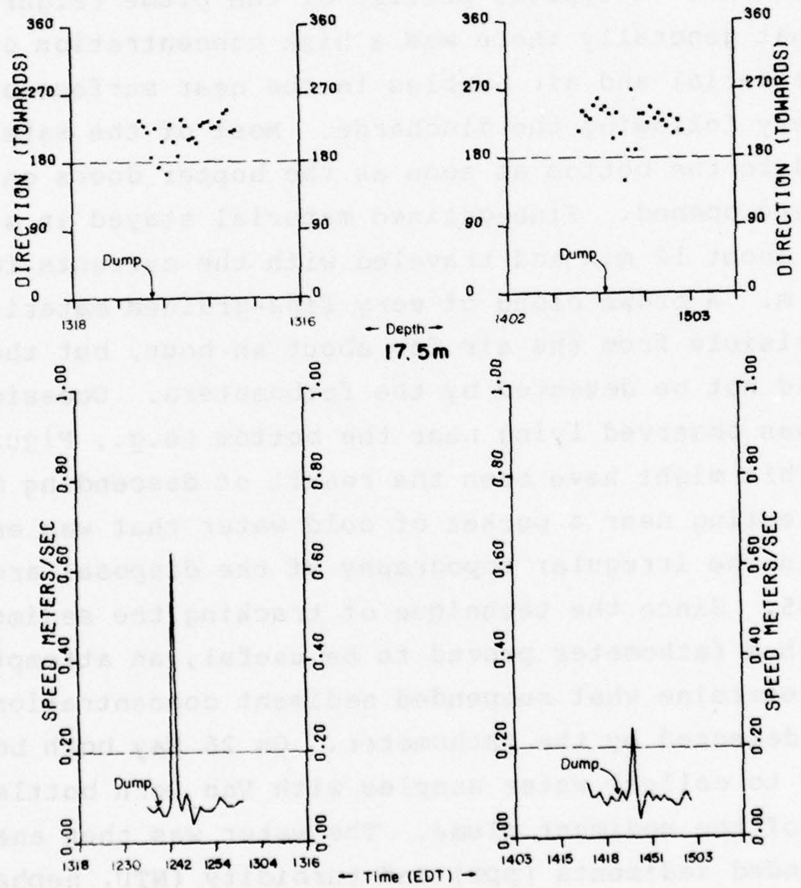


Figure B30. Current speed and direction changes observed during two dumps of dredged material on 26 May 1976

was less at 3 m from the bottom and at middepth than near the bottom. This suggests that the momentum of the falling material produced disturbances that spread out along the bottom rather than spreading out uniformly throughout the water column.

164. Two vessels were used to trace the sediment plume and to measure the distribution of the suspended sediments with fathometers. Several of the acoustic profiles of the sediment plume recorded by the two vessels are included in Appendix W'. A typical profile of the plume (Figure B31) showed that generally there was a high concentration of dredged material and air bubbles in the near surface area immediately following the discharge. Most of the material descended to the bottom as soon as the hopper doors on the dredge were opened. Fine-grained material stayed in suspension for about 12 min and traveled with the currents for more than 100 m. A brown cloud of very fine-grained material was usually visible from the air for about an hour, but the material could not be detected by the fathometers. Occasionally a plume was observed lying near the bottom (e.g., Figure W'11). This might have been the result of descending material collecting near a pocket of cold water that was entrapped within the irregular topography of the disposal area.

165. Since the technique of tracking the sediment plume with a fathometer proved to be useful, an attempt was made to determine what suspended sediment concentrations could be detected by the fathometer. On 26 May both boats were used to collect water samples with Van Dorn bottles at the edge of the sediment plume. The water was then analyzed for suspended sediments (ppm) and turbidity (NTU, nephelometric turbidity units). The depth where the samples were collected could be estimated as the sample bottles frequently appeared on the acoustic profiles. When the water samples were analyzed and the results correlated with the readings

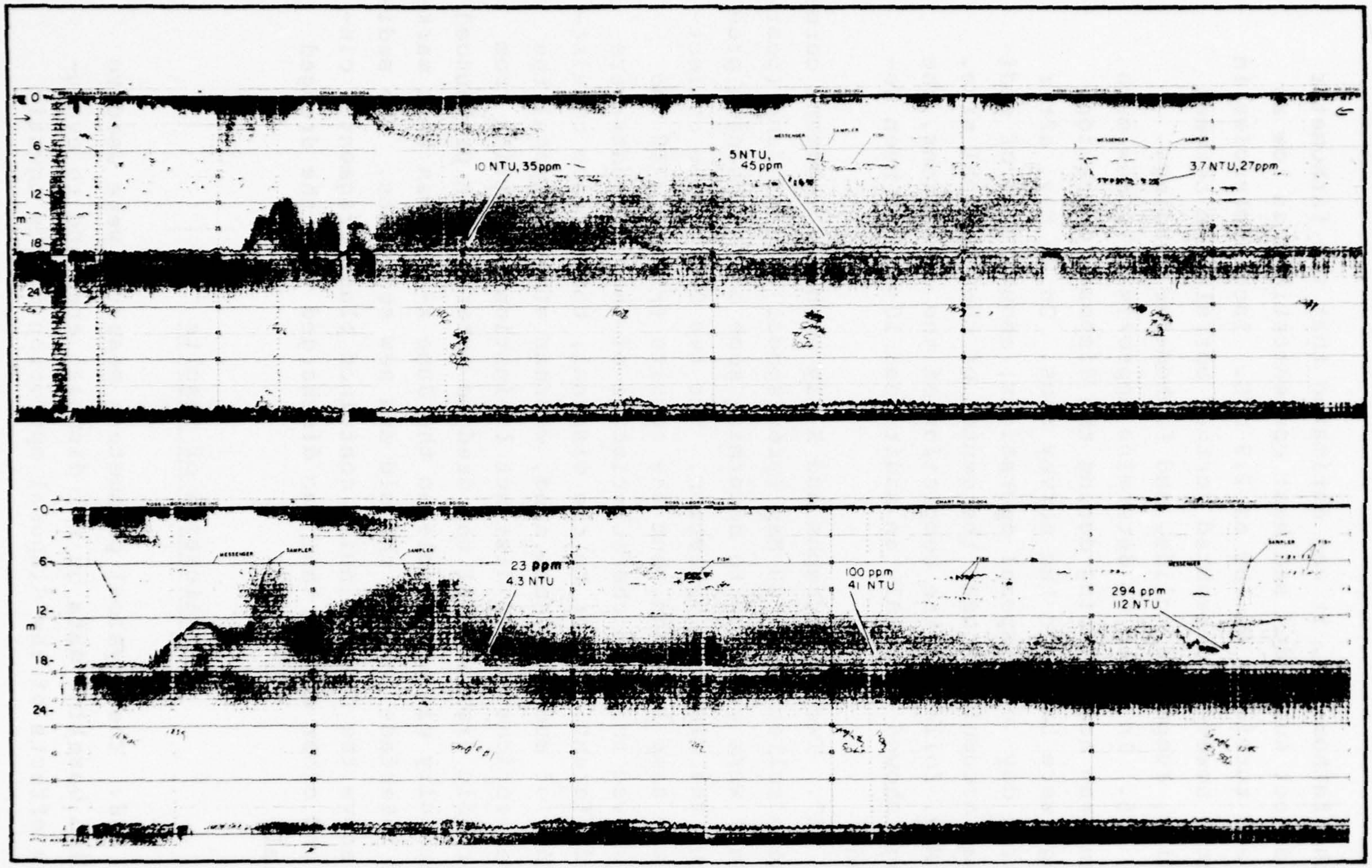


Figure B31. Acoustic profiles of suspended sediments collected during the fourth dump (top) and third dump (bottom) on 26 May. Ppm denotes concentrations of suspended sediment and NTU's are turbidity measurements

from the fathometer, it was estimated that the fathometer could detect suspended sediment concentrations as low as 2 ppm and turbidity as low as 2.9 NTU. Inconsistencies in the data, however, prevented further correlation between turbidity, suspended solids, and fathometer readings.

166. In order to determine approximately how much sediment was accumulating during the disposal operation, readings were taken on the survey rods. On 25 May, after the first day of disposal operations, about 18 cm of sediment had accumulated near the center of the disposal site. On 26 May, following the completion of the operations, the readings showed that only an additional 10 cm had been deposited.

167. Two radiographs and X-ray scans of sediment cores that were collected on 20 May (predisposal) and 13 June (post-disposal) were examined to determine some of the changes produced by the disposal operation. The two cores were collected at the same location, but the results (Figure W'12 and W'13) showed that the characteristics of the sediments were quite different. Prior to the disposal, the surface consisted mainly of mud with some sand, whereas after disposal the surface sections showed distinct laminations resulting from the periodic discharge of the dredged material. A pronounced discontinuity was noticeable on the June X-ray scan that marked the interface between the old and new sediments. The sediments above the discontinuity contained plant fragments, cinders, and other debris that was discharged with the dredged material.

Evaluation of Results

168. The physical parameters measured were used to establish baseline data on the disposal area and to evaluate the effects of the disposal operation on the aquatic

environment. The data were further used to describe the sediment pile resulting from the disposal operation and to monitor changes that occurred in the pile as a result of erosion, deposition, and compaction. The integration of several types of data (e.g., survey rods, sediment traps, and bathymetry) permitted some specific inferences to be drawn especially when a noticeable change in the data occurred. An overview of the results and observed relationships among the parameters measured is discussed below.

169. Monitoring of the deposited sediment piles indicated that the piles were quite small and that decreases in the thickness of the disposed material were due mainly to erosion that occurred during storm conditions. The survey rod, sediment trap, and bathymetric data all indicated that less than 0.5 m of dredged material was deposited at the disposal sites. Radiographs and X-ray scans of sediment cores collected near ND also indicated that less than 0.5 m of new sediment had accumulated as a result of the disposal operation. The survey rod data, supported by the diver's observation of scour marks, indicated that the sediment pile had partially eroded in the months following the disposal operation. The survey rod at D2 showed that 5 cm of sediment had eroded between 14 August and 16 October 1975. However, an additional 10 cm was removed during the next 30 days. Storms that occurred on 18 October and 10 November probably caused most of the erosion during that period. During the October storm the currents near the bottom were nearly 30 cm/sec and the wave orbital velocity exceeded 10 cm/sec; on 10 November the currents near the bottom exceeded 50 cm/sec for a short time. Apparently these bottom, storm-related currents were responsible for more erosion to occur during these 2 days than had occurred during the preceding 2 months. The SEDMOT results indicated that the sediment transport on 18 October was toward the west-southwest, whereas on 10 November it was

toward the northeast. The results further indicated that the sediments might have been transported as far as 20 km, which suggests that the eroded sediments were well dispersed.

170. The survey rod data at ND indicated that there was less erosion during the 1976 study period than was observed during 1975. This was expected, however, as the last sampling date at ND was on 13 September which was before any severe storms occurred in the area. The results from SEDMOT also indicated that there was very little erosion as there were no episodes between May and September 1976 when sediment transport occurred (i.e., the current velocity did not exceed the assumed erosional velocity of the sediment). The sediment trap data at ND indicated that negligible compaction occurred between May and September 1976. This implies that any decrease in the sediment pile was due mainly to erosion.

171. The water currents were the main source of energy for sediment resuspension and transport. The current speeds 1 m from the bottom frequently exceeded 30 cm/sec and occasionally became as high as 50 cm/sec. The mean speed at the 1-m level, however, was less than 10 cm/sec and the higher speeds occurred only during wind storms. The currents were generally quite variable with large velocity shears over depth (especially near the thermocline). Such variability might have aided in dispersing the resuspended sediments. Wave orbital velocities also provided energy for sediment resuspension, but the velocities rarely exceeded 15 cm/sec at the bottom. The disposal area was approximately 17 m deep, and consequently the energy from the waves was greatly diminished near the bottom. Wave energy, however, may be very important in transporting and redistributing dredged material in disposal areas located in shallower water.

172. The multivariate analysis of variance of the grain-size distribution data for 1975 indicated that there was a detectable change in the grain-size distribution of the

surface sediments following the disposal operation. The univariate analysis of variance and the plots of the percent clay in the sediments versus time both showed that the change was due, in part, to a substantial drop in the amount of clay in the surface sediments. There was also a noticeable increase in silt at the harbor sediment disposal site (D2). The discriminate analysis also detected the changes caused by the disposal operation in 1975, but it further indicated that, by November, the grain-size distribution at some stations had reverted to predisposal values. This suggests that the waves and currents associated with the storms in October and November had either removed the dredged material or had redistributed it such that the grain-size distribution was indistinguishable from the predisposal samples.

173. Several other analyses were performed on the sediment data to determine how the sediments changed and where they were transported. Folk's moment statistics (Folk 1974) and cluster analysis were performed on the grain-size data, but the results provided no additional information on the distribution and movement of the dredged material. Linear trend surface analysis was also performed on the grain-size data, but, again, the results were inconclusive in determining the direction of sediment transport. The above methods failed, in part, because the dredged material was so similar in composition to the original lake bottom that the analyses could not readily distinguish between the two.

174. Measurements taken during the disposal operation indicated that the actual discharge of material had no lasting effect on the physical environment. Measurements taken from an anchored vessel located approximately 70 m from the point of discharge showed a temporary 2°C increase in temperature and occasional surges in the currents with speeds as high as 70 cm/sec. These effects were quite transient, however, and disappeared within a few minutes. Measurements

taken approximately 200 m and farther from the point of discharge generally showed no changes from the ambient conditions, which indicates that the effects of the discharge were quite local. Attempts to measure the configuration of the sediment plume by using moving survey vessels and fathometers were not successful because most of the discharged material settled to the bottom too quickly. The currents, temperature, and transmissivity generally returned to their ambient values within an hour following the discharge of material.

PART IV: SUMMARY AND CONCLUSIONS

175. The investigation of the hydraulic regime and the physical nature of the bottom sedimentation at the disposal site near Ashtabula, Ohio, was conducted during the period June 1975 to September 1976. The various physical parameters monitored during the period included bathymetry and subbottom profiles; currents, temperature, and transmissivity within the water column; wave characteristics; bottom sediment distribution; meteorological conditions of the study area; and hydrological conditions of Lake Erie and the Ashtabula River.

176. Bathymetry measurements within the disposal area indicated that the maximum thickness of the sediment pile resulting from the disposal operation was less than 0.5 m and in most cases could not be accurately measured with standard acoustic methods. The survey rods and sediment traps proved to be the most effective methods to measure the sediment accumulation. The results of these measurements indicated that approximately 70 percent of the disposed material fell within the 160,000-m^2 study area. Some of this material was removed from the study area within 3 months due to resuspension and subsequent transport from the area. The currents were the main source of energy for sediment transport as most of the wave energy did not penetrate to the bottom.

177. The currents in the disposal area generally flowed parallel to the shore with average speeds of 12 cm/sec at the 3-m level and 5 cm/sec at the 1-m level. The dominant periodic component of the velocity field was the first longitudinal mode of Lake Erie, which had a period of 14 hr. The currents, at times, were uniform over the entire study area and changes in the local winds usually did not immediately affect the established flow pattern. The wave field, however, was directly influenced by the local wind. The waves were

usually less then 1 m but increased to over 2 m during storms.

178. Analysis of over 200 sediment cores revealed that the disposal operation produced only minor changes in the grain-size distribution of the sediments. The variations in sand, silt, and clay were not immediately apparent in the raw data; however statistical analysis performed to detect the changes revealed a noticeable decrease in clay at disposal sites D2 and D8 and an increase in silt at site D2. These changes, however, were quite transient as these variables generally returned to their predisposal values within 3 months.

179. The measurements taken during the disposal operation indicated that the actual discharge of material had no lasting effect on the environment. A temporary temperature increase of 2°C and currents of up to 70 cm/sec were produced near the disposal site by the discharged material, but such conditions also occurred naturally in this area. The transmissivity dropped to zero following the sediment discharge, but it also frequently dropped to zero following a storm. Within an hour after the disposal, the currents, temperature, and transmissivity had virtually returned to their ambient values in the disposal area.

180. Several measuring techniques and methods of data analysis were used during this study to determine the effects of dredged material disposal. Based on the experience gained from this study, the following conclusions and recommendations can be made:

a. Bathymetry measurements for detecting the sediment pile can only be used when a very large sediment pile results from the disposal operation. The study site should have a very smooth area so that irregularities in the predisposal bathymetry will not distort results.

b. Subbottom profiles and shear strength measurements are not useful in defining the sediment pile.

c. Survey rods, sediment traps, and radiographs are very effective in measuring the sediment accumulation. A closely spaced rectangular grid can be used to accurately measure the sediment pile.

d. Sediment cores taken in a rectangular grid pattern are necessary to obtain significant information on the changes in physical characteristics of sediments due to the disposal operation.

e. It is necessary to analyze sediment cores for at least 11 grain sizes with a minimum of four replicates. These parameters must remain constant to facilitate the statistical analysis.

f. Trend surfaces, cluster analysis, and Folk's moment statistics of grain-size data are not useful in tracking the dredged material when the dredged material is similar in composition to the original lake bottom.

g. A more stable platform than a vessel anchored from one point is required for accurate current profile measurements.

h. More than one permanent current-meter mooring is necessary to determine flow variations within the study area.

i A wave gauge located in shallow water with measurements taken every 0.25 sec is needed to provide useful data in order to assess the contributions of wave motions to sediment movement.

j. Erosion of the disposed sediment occurs mostly during large storms. Since most storms occur during late fall and winter, detailed measurements during these periods are required to monitor

changes in the sediment pile.

k. Determining the direction of sediment transport proved to be difficult. A method of tagging the dredged material would be invaluable in tracking the material.

181. The measurements taken in the disposal area and the subsequent analysis of the data indicate that the disposal of the dredged material has very little effect on the physical nature of the area. However, the significance of the physical factors in contributing to the total effects of the disposal operations can be fully understood only when analyzed together with the impacts associated with chemical and biological effects.

LITERATURE CITED

Bass, J.C., and R.M. Byrnes. 1974. Precision electro-optical wave and tide gauge. A.S.C.E. Sym. on Ocean Wave Measurement and Analysis, New Orleans. 2:190-199.

Blanton, J.O., and A.R. Winklhofer. 1971. Circulation of hypolimnion water in the central basin of Lake Erie. Proc. 14th Conf. Great Lakes Res. 788-798.

Boyd, M.B., R.T. Saucier, J.W. Keeley, R.L. Montgomery, R.B. Brown, D.B. Mathis, and C.J. Guice. 1972. Disposal of dredge spoil: problem identification and assessment and research program development. TR H-72-8. U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Cohen, C.E., and P. Burns. 1973. Clustan 6000 users manual. Vogelback Computer Center, Northwestern University, Evanston, Ill.

Cooley, J.W., and J.W. Tukey. 1965. An algorithm for the machine calculation of complex Fourier coefficients. Math. Comput. 19:297-301.

Dill, R.F., and D.G. Moore. 1965. A diver-held vane-shear apparatus. Marine Geology. 3:323-327.

Dixon, W.J. (ed.) 1975. Biomedical computer programs. University of California Press, Los Angeles. 792 pp.

Evans, J. 1973. Environmental radioactivity investigations of Lake Erie sediments with special attention to Cs^{137} as an aide in determining sedimentation rates. Unpubl. M. Sc. Thesis. Dept. of Zoology, Ohio State Univ. Columbus, Ohio. 56 pp.

Folk, R.L. 1974. Petrology of sedimentary rocks. Hemphill, Austin, Texas. 182 pp.

Gedney, R.T., and W. Lick. 1971. Numerical calculations of the wind-driven currents in Lake Erie and comparison with measurements. Proc. 14th Conf. Great Lakes Res. 454-466.

Hamblin, P.F. 1971. Circulation and water movement in Lake Erie. Inland Waters Branch, Dept. of Energy Mines and Resources, Ottawa, Canada. Sci. Ser. No. 7. 49 pp.

Herdendorf, C.E. 1967. Lake Erie bathymetrographic recordings 1952-1966. Info. Circ. No. 34, State of Ohio, Dept. Nat. Resources. 36 pp.

Hjulstrom, F. 1939. Transportation of detritus in moving water. Pages 5-31 in P.D. Trask, ed. Recent marine sediments: Tulsa, Am. Assoc. Petroleum Geologists.

Hough, J.L. 1958. Geology of the Great Lakes. Univ. Illinois Press, Urbana. 313 pp.

Hutton, C.W. 1940. Geology of the Conneaut and Ashtabula Quadrangles, Ohio. Unpubl. M.A. Thesis. Ohio State Univ., Columbus, Ohio. 66 pp.

International Working Group on the Abatement and Control of Pollution from Dredging Activities. 1975. Report. 227 pp.

Kick, J.F. 1962. An analysis of the bottom sediments of Lake Erie. MA. Thesis. Univ. of Toronto., Toronto, Ontario. 174 pp.

Kim, Y.Y., and L.H. Simons. 1974. Sea state measurements from pressure records. A.S.C.E. Sym. on Ocean Wave Measurement and Analysis, New Orleans. 1:40-53.

Kinsman, B. 1965. Wind waves; their generation and propagation on the ocean surface. Prentice-Hall, Englewood Cliffs, N.J. 676 pp.

Kramer, C.Y., and D.R. Jensen. 1969. Fundamentals of multivariate analysis, Part II. Inference about two treatments. J. Quality. Tech. 1(3):189-204.

Leahy, J.E., W.B. Lane, T.M. Tami, L.B. Inman, W.R. McLoud, and N.J. Adams. 1976. Dredged sediment movement tracing in San Francisco Bay utilizing neutron activation. TR N-76-1. U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Liu, P., and T. Kessenich. 1975. Surface wave data recorded in Lake Ontario during IFYGL. NOAA Technical Memorandum, ERL, GLERL-2. 197 pp.

McBride, R.T.J. 1975. Distribution of recent sediments in Maumee Bay, Western Lake Erie. M.S. Thesis. Univ. of Toledo., Toledo, Ohio. 155 pp.

McClennen, C.E., and W.P. Kramer. 1976. Sediment transport using computer processing of current meter data. Unpubl. Manuscript. Univ. of Rhode Island, Kingston, R.I. 12 pp.

McDonald, W.E. 1954. Variation in Great Lakes levels in relation to engineering problems. Proc. 4th Conf. Coastal Engineering. 249-257.

Morrison, D.F. 1967. Multivariate Statistical Methods. McGraw-Hill, New York. 338 pp.

Mortimer, C.H. 1971. Large-scale oscillatory motions and seasonal temperature changes in Lake Michigan and Lake Ontario. Spec. Rept. No. 12. Center for Great Lakes Studies, Univ. of Wis., Milwaukee, Wis. 111 pp.

NALCO ES. 1975. Climatology of Ashtabula, Ohio. Rept. to the U.S. Army Corp of Engineers, Waterways Experiment Station, Vicksburg, Miss. 15 pp.

__________. 1976. Mineralogy of the sediments of Lake Erie near Ashtabula, Ohio. Rept. to the U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Miss. 14 pp.

Nie, N.H., C.H. Hull, J.G. Jenkins, K. Steinbrenner, and D.H. Bendi. 1975. Statistical Package for the Social Sciences. McGraw-Hill, New York. 675 pp.

Pinsak, A.P. 1968. Water transparency in Lake Erie. Misc. Publ. 68-3. U.S. Lake Survey, CE, Detroit, Mich.

Rao, C.R. 1970. Advanced Statistical Methods in Biometric Research. Hafner Publ. Co., Conn. 390 pp.

Rockwell, D.C. 1964. Theoretical free oscillations of the Great Lakes. Pub. No. 15:352-368. Great Lakes Res. Div., Univ. of Michigan, Ann Arbor, Mich.

Rukavina, N.A., and G.A. Duncan. 1970. F.A.S.T - Test analysis of sediment texture. Proc. 13 Conf. Great Lakes Res. 274-281.

Scheffe, H. 1959. The analysis of variance. John Wiley and Sons, Inc., New York. 477 pp.

Sly, P.G. 1973. The significance of sediment deposits in large lakes and their energy relationships. I.A.H.A. - A.I.S.H. Pub. No. 9 in Hydrology of Lakes Symp. Proc., Helsinki Symp. 383-396.

Sternberg, R.W. 1972. Predicting initial motion and bedload transport of sediment particles in the shallow marine environment. Pages 61-82 in Swift, Duane, and Pilkey, eds. Shelf sediment transport. Dowden, Hutchinson, and Ross, Inc., Stroudsburg, Pa.

Stewart, K.M. 1973. Winter conditions in Lake Erie with reference to ice and the thermal structure and comparison to Lake Winnebago (Wisconsin) and Mille Lacs (Minnesota). *Proc. 16th Conf. Great Lakes Res.* 845-857.

Sundborg, A. 1967. Some aspects on fluvial sediments and fluvial morphology, I. General views and graphic methods. Geograf. Ann. 49A:333-343.

U.S. Dept. of Commerce. 1959. Climatology and weather services of the St. Lawrence Seaway and Great Lakes. Weather Bur. Tech. Paper No. 35. U.S. Government Printing Office, Washington D.C. 75 pp.

Verber, J.L. 1966. Inertial currents in the Great Lakes. Pub. No. 15:375-379. Great Lakes Res. Div., Univ. of Michigan, Ann Arbor, Mich.

Table B1

Tabulation of Data for Surveys Conducted During the Study Period

Date		Bathymetry Large Scale	Control	D2	D8	ND	Currents	Transmissivity	Temperature	Traps	Vaneshear	Survey Rods	Cores
Jun 24-27	1975	X											
Jul 8		X											
10							X	X	X				
11		X					X	X	X				
31									X			X	
Aug 1							X	X	X				
2				X	X								
4			X										
5							X	X					
8				X	X		X	X					
14				X	X		X	X	X			X	
15				X	X							X	
Sep 11												X	
14			X	X	X		X	X	X				
Oct 16							X	X	X			X	
Nov 12					X							X	
16			X	X			X	X	X				
Dec 20									X				
Mar 26	1976			X	X		X	X	X				
28							X	X	X				
Apr 20				X	X								
21							X	X	X				
May 13					X		X	X	X				
14				X		X				X		X	
15										X		X	
20													X
24						X	X			X		X	
25						X	X		X				
26						X	X	X	X	X		X	
27						X							
Jun 7							X	X	X				
8				X	X	X				X	X	X	X
9										X	X	X	X
10										X	X	X	X
13										X	X	X	X
Jul 7										X	X	X	
8				X	X					X	X	X	X
9						X	X	X	X	X	X	X	X
Sept 8										X	X	X	X
9		X				X	X	X	X	X	X	X	X
12										X	X	X	
13		X								X	X	X	X

Table B2

Mean Daily Discharge
and Mean Daily Total Suspended
Sediments of the Ashtabula River for the Period 1969-1973

Low Flow		Medium Flow		High Flow	
Q	TSS	Q	TSS	Q	TSS
18.00	0.05	170.70	2.80	1685.80	518.00
75.20	0.80	108.85	1.51	1939.10	897.80
75.20	0.40	333.60	7.17	772.80	84.80
35.90	0.10	550.00	51.94	2321.60	1022.50
30.00	0.41	333.60	18.00	1299.80	160.80
27.10	0.87	188.70	7.10	1881.80	1130.00
14.90	0.08	206.40	5.58		
2.57	0.01	350.70	22.00		
3.00	0.03	368.70	8.94		
4.20	0.02	164.00	2.10		
6.40	0.05	116.70	6.70		
84.00	1.40	368.70	18.00		
12.90	0.04	175.90	7.60		
73.00	1.40				
34.10	0.37				
47.00	0.24				
8.20	0.13				
1.62	0.10				
20.10	0.22				
38.10	0.41				
0.80	0.01				

Note: Q = Discharge in cubic feet per second
TSS = Total suspended sediments in tons per day.

Table B3

Predicted Mean Daily Total Suspended Sediments of the Ashtabula River Corresponding to the Mean Daily River Discharges During the Transmissivity Measurement Dates

Date	Discharge cfs	Total Suspended Sediments tons/day
31 July 1975	0.40	0.00
5 August 1975 (Disposal Op.)	5.00	0.02
8 August 1975 (Disposal Op.)	5.00	0.02
14 August 1975	0.95	0.00
14 September 1975	6.40	0.02
17 October 1975	32.00	0.38
16 November 1975	61.00	1.14
28 March 1976	93.00	2.37
21 April 1976	15.00	0.10
14 May 1976	30.00	0.34
24 May 1976 (Disposal Op.)	24.00	0.23
25 May 1976 (Disposal Op.)	20.00	0.17
26 May 1976 (Disposal Op.)	17.00	0.13
7 June 1976	6.20	0.02
9 July 1976	20.00	0.17
9 September 1976	3.50	0.01

Table B4

Visual Description of the Lake Bottom Observed by a Diver During Sediment Trap Collection

Station	Date: 14 May 1976	Date: 10-13 June 1976
1	Flat topography, surface to 60 cm fluffy; impenetrable material below.	Hilly topography, sandy, dirty sediments.
2	Scattered shale fragments, coarse material.	Area littered with leaves and other organic material. Alternating layers of coarser and finer material down to 30 cm.
3	Shale fragments (approximately 12 cm in diameter) scattered about the area.	Shale fragments covered with a trace of fluffy material.
4	Shale with occasional mud covering.	Shale covered by 1-2 cm of silt. Ripple marks on silt.
5	Shale	Shale covered by trace of sediments.
6	Shale with occasional mud covering.	Shale, covered by muddy material. Mud littered with leaves and other organic constituents.
7	30-cm layer of shale fragments over soft material.	25 cm of mud over shale fragment.
8	Silt	Fluffy material over silt.
9	Cobbles and gravel over shale.	Shale, occasional gravel and cobbles.
10	Shale covering mud.	Fluffy to silty material littered with leaves and other organic constituents.
11	8 cm of sediments over shale.	26 cm of fluffy material over 6 cm of original sediments. Hilly topography with ripple marks. Shale below original sediments.
12	70 cm of mud over consolidated material.	Soft material over silt.
13	Slightly consolidated silt. Bottom flat.	Trace of mud over slightly consolidated silt. Bottom flat.
14	Shale fragments lying on top of hard granular material.	Fluffy light material over hard granular material.
15	12 cm of gravel and shale fragments over soft material.	10 cm of silt over shale fragments.
16	30 cm of silt over gravel and sand.	Gravel and sand covered with powdery material. Ripple marks. Bottom littered with leaves and other organic material.
17	Mixed sand and clay material.	Sand and fluffy material over clay.
C3	Mud	Mud
D2		
D8		

(continued)

Table B4 (concluded)

Station	Date: 7-10 July 1976	Date: 9-13 September 1976
1	No change from June observation.	Sediment very dirty. Old Coast Guard buoy at site lost due to storm. No visible marks at bottom due to possible drag of its anchor. Bottom flat.
2	No change from June observation.	Little evidence of dredged material, clean sediment.
3	Scour around survey rods.	Flat bottom. Trace of sediments. No scour marks, old marks filled in.
4	No change from June observation.	No change from June observations.
5	No trace of sediments over shale.	Organic fallout covers shale.
6	No change from June observation.	Dredged material evident in the form of leaves, sticks. Gas bubbles escaping from sediment.
7	No change from June observation.	No change from June observations.
8	No change from June observation.	No change from June observations.
9	No change from June observation.	No change from June observations.
10	No change from June observation.	Dredged material apparent in the form of leaves, sticks.
11	Scour around survey rods. No traces of diver's previous presence evident. Depressions are filled in.	Presence of large number of clay balls. 7 cm of scour in a radius of 50 cm around large shale fragments.
12	Soft muddy material over silt. Patches of harder sediment within the mud and silt.	Brown flat bottom. Material underneath black in color.
13	No change from June observations.	Bottom flat, 3-4 cm of fluff. Color brownish on top, black underneath.
14	No change from June observation.	Sediment dirty (dredged material), bottom flat.
15	Shale, covered by some silt.	10 cm dredged silt, rock below.
16	Scour around survey rods.	Spider web-shaped white growth at the bottom. Evidence of diver's previous activity. Sand layer at about 10-13 cm beneath flat bottom.
17	Sand over silty material. Ripples up to 3 cm high.	Symmetrical ripple marks in sand. Trace of sediments.
C3	Mud	Organic fallout accumulated in the traps (1 cm) and on the bottom (7 cm). Mud below.
D2	Slightly rippled flat bottom, with top layers of fine material. No evidence of dredged material.	
D8	Gently rolling bottom of granular, dirty sand. Surface material similar in appearance to dredged material.	

APPENDIX A': INSTRUMENTATION AND METHODS

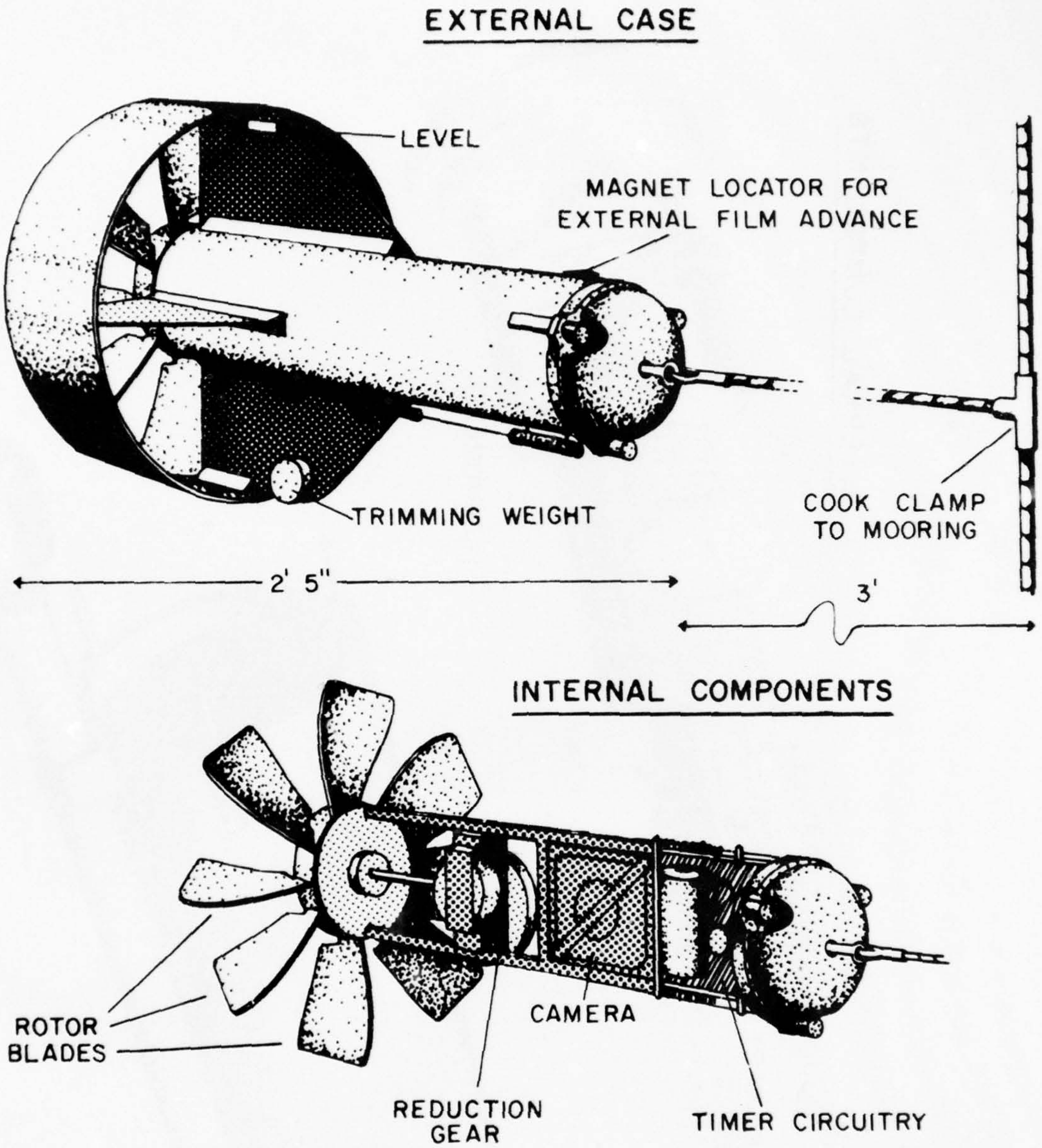


Figure A'1. ENDECO type 105 current meter

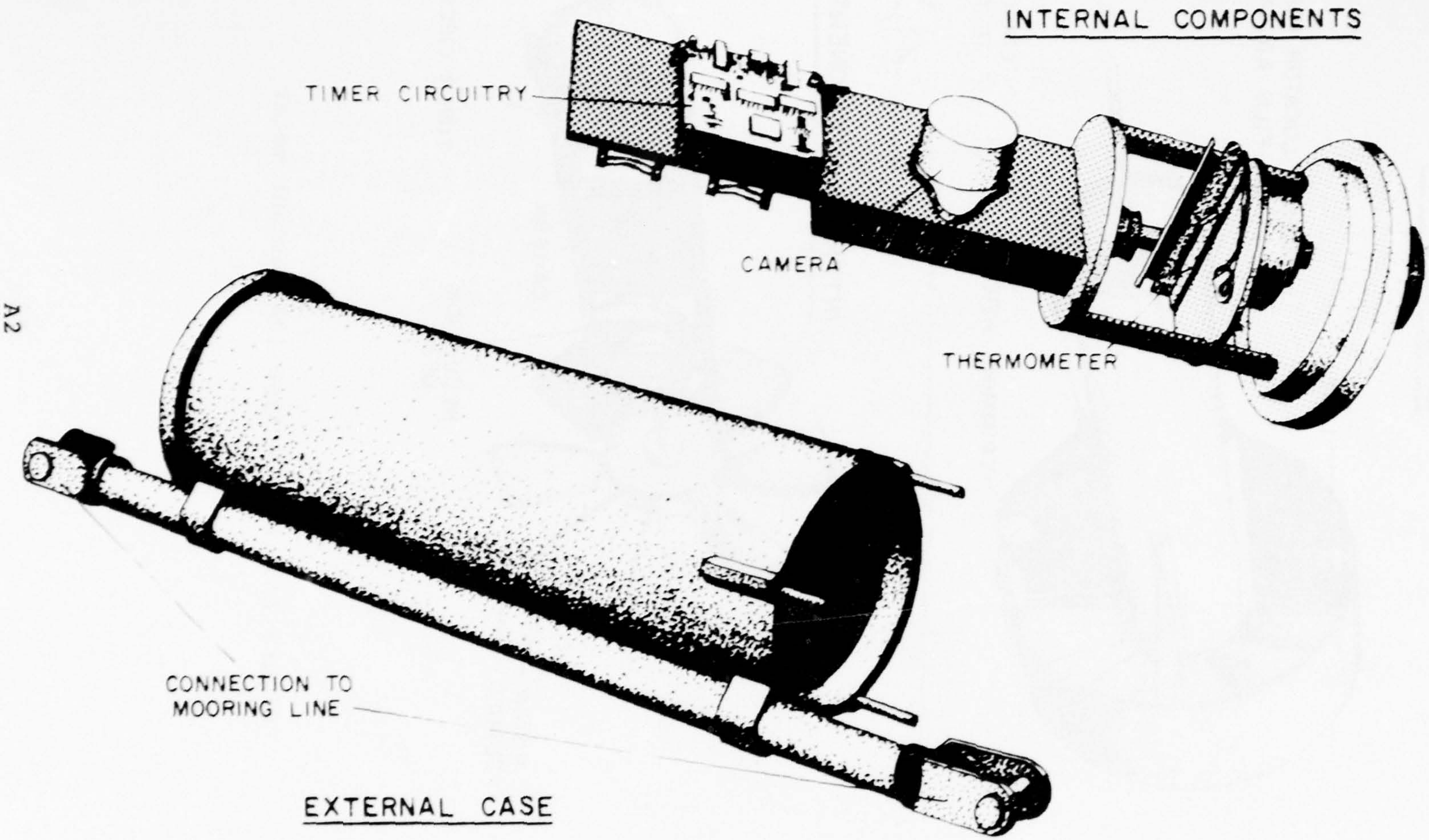


Figure A'2. ENDECO type 109 thermograph

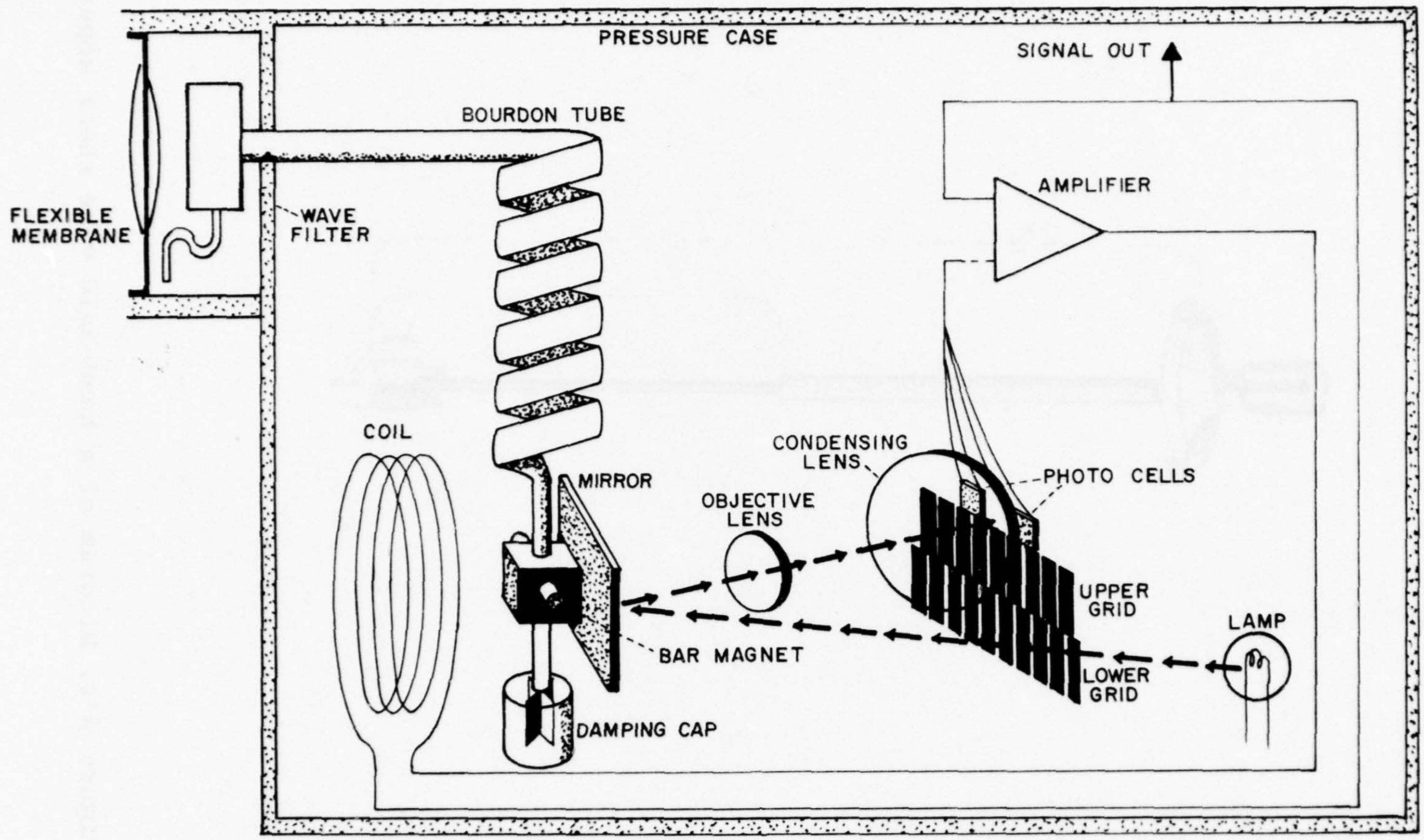


Figure A'3. Optical lens system of the Bass Engineering Model WG/100M wave gauge

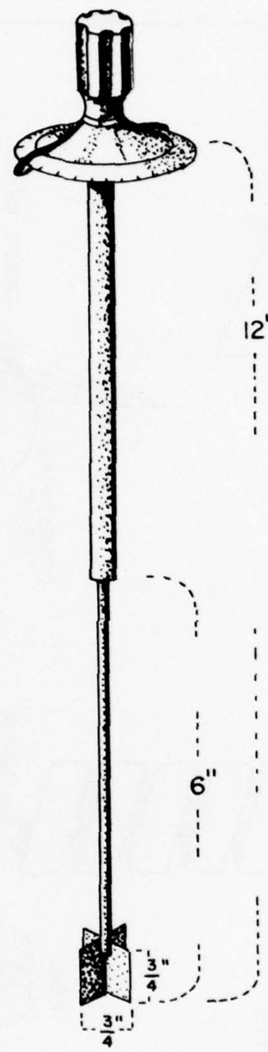


Figure A'4. Diagram of a hand-held vane shear apparatus

APPENDIX B': BATHYMETRY

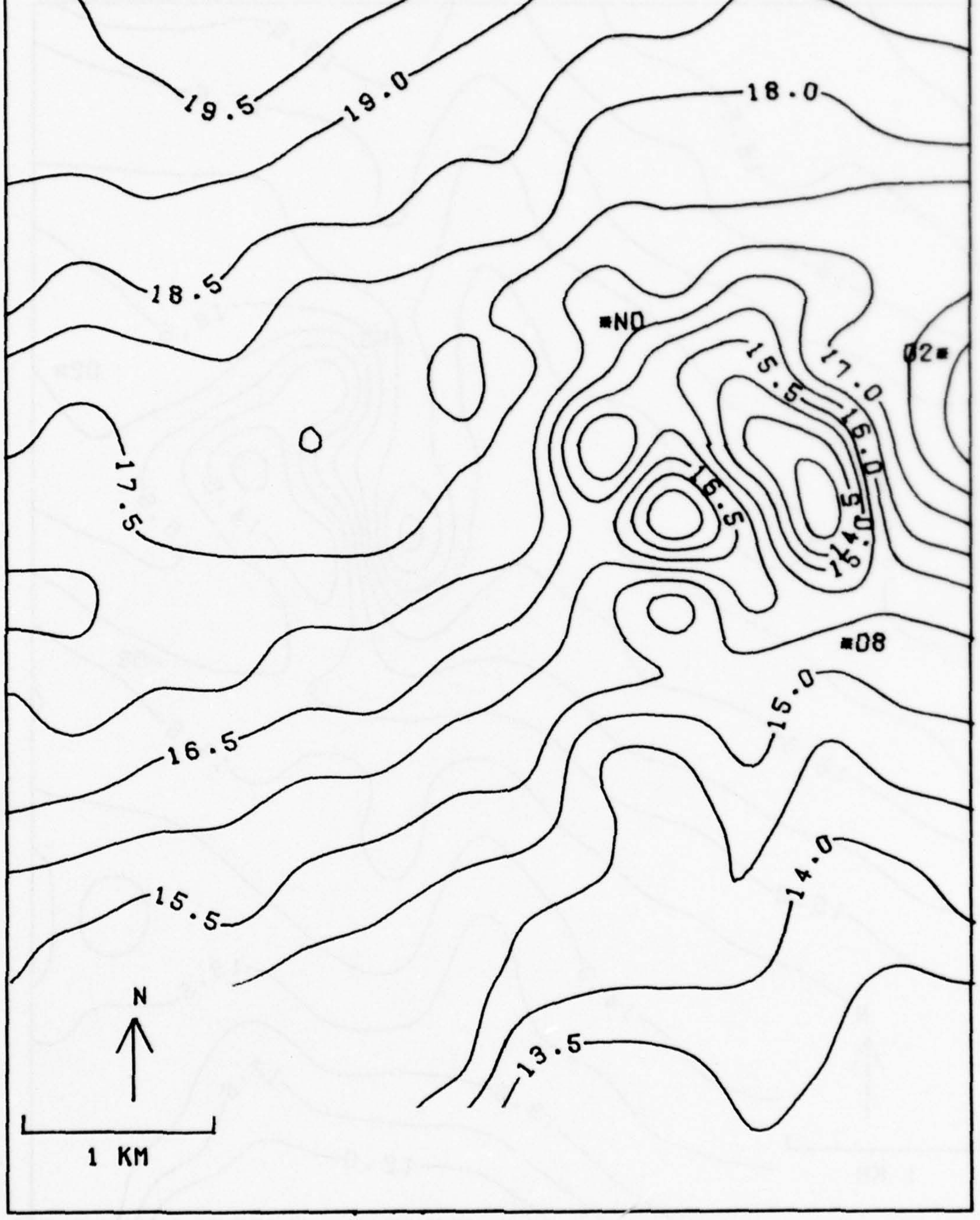


Figure B'1. Large-scale bathymetry for July 1975, contours are in meters.

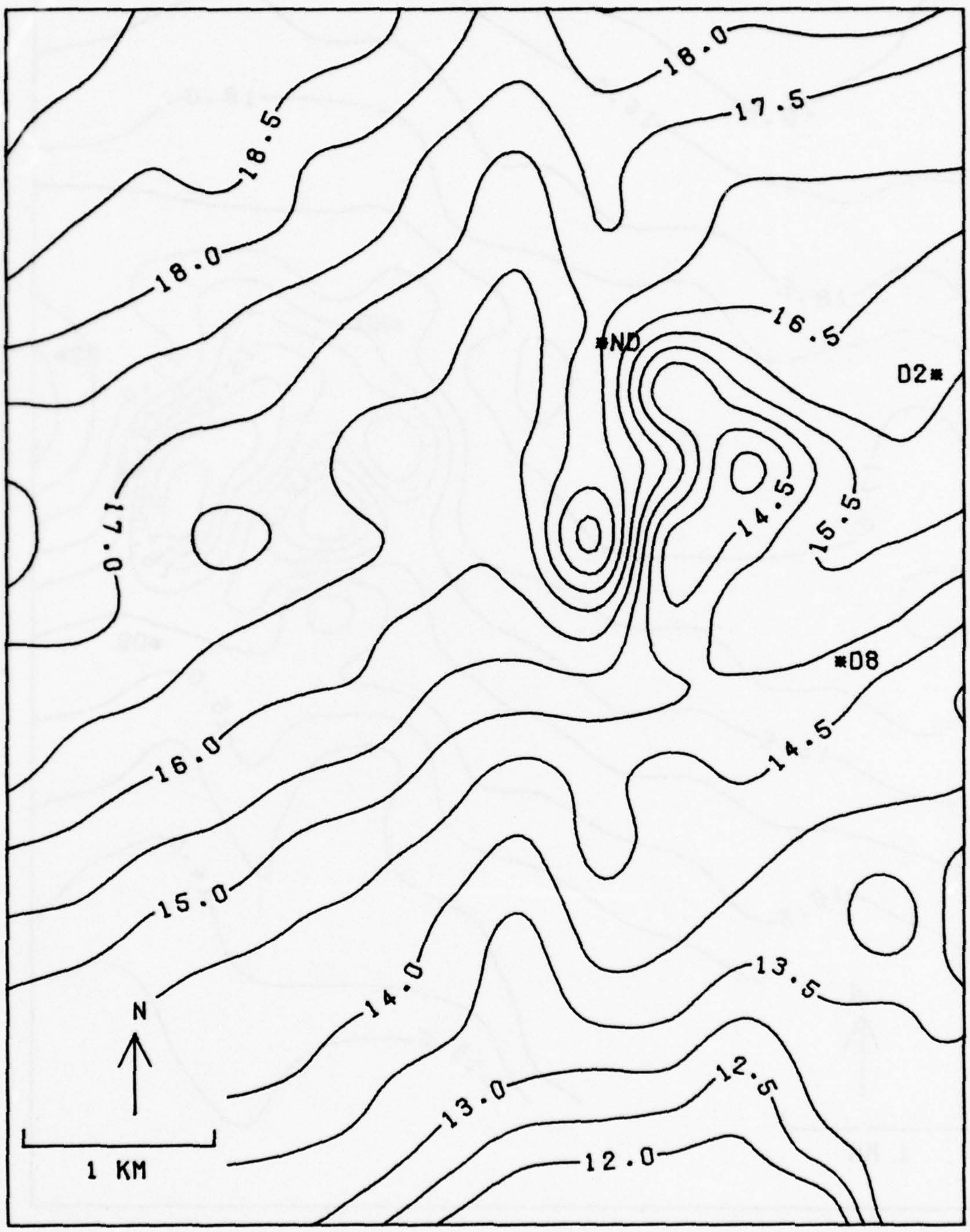


Figure B'2. Large-scale bathymetry for September 1976

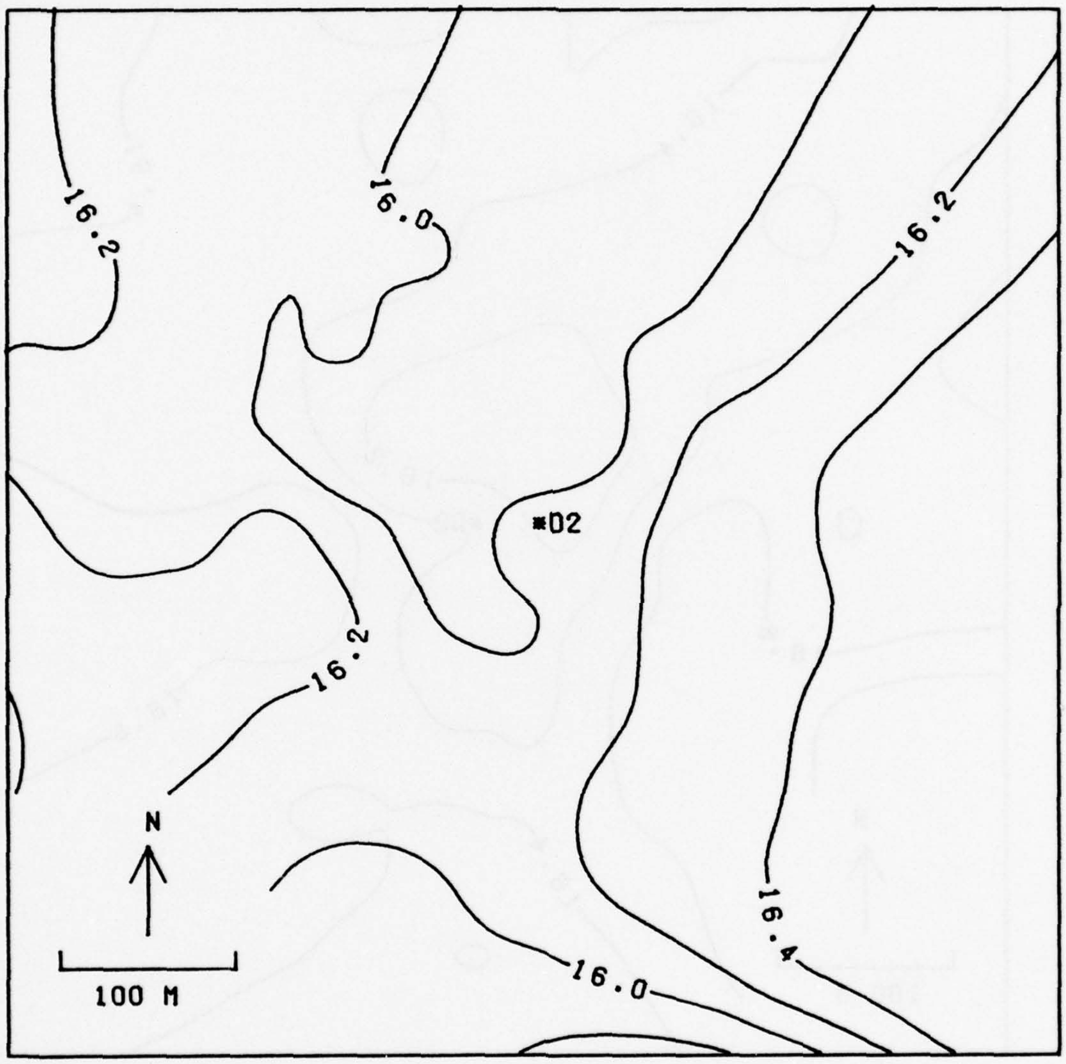


Figure B'3. Detailed bathymetry for 8 August 1975 on site D2

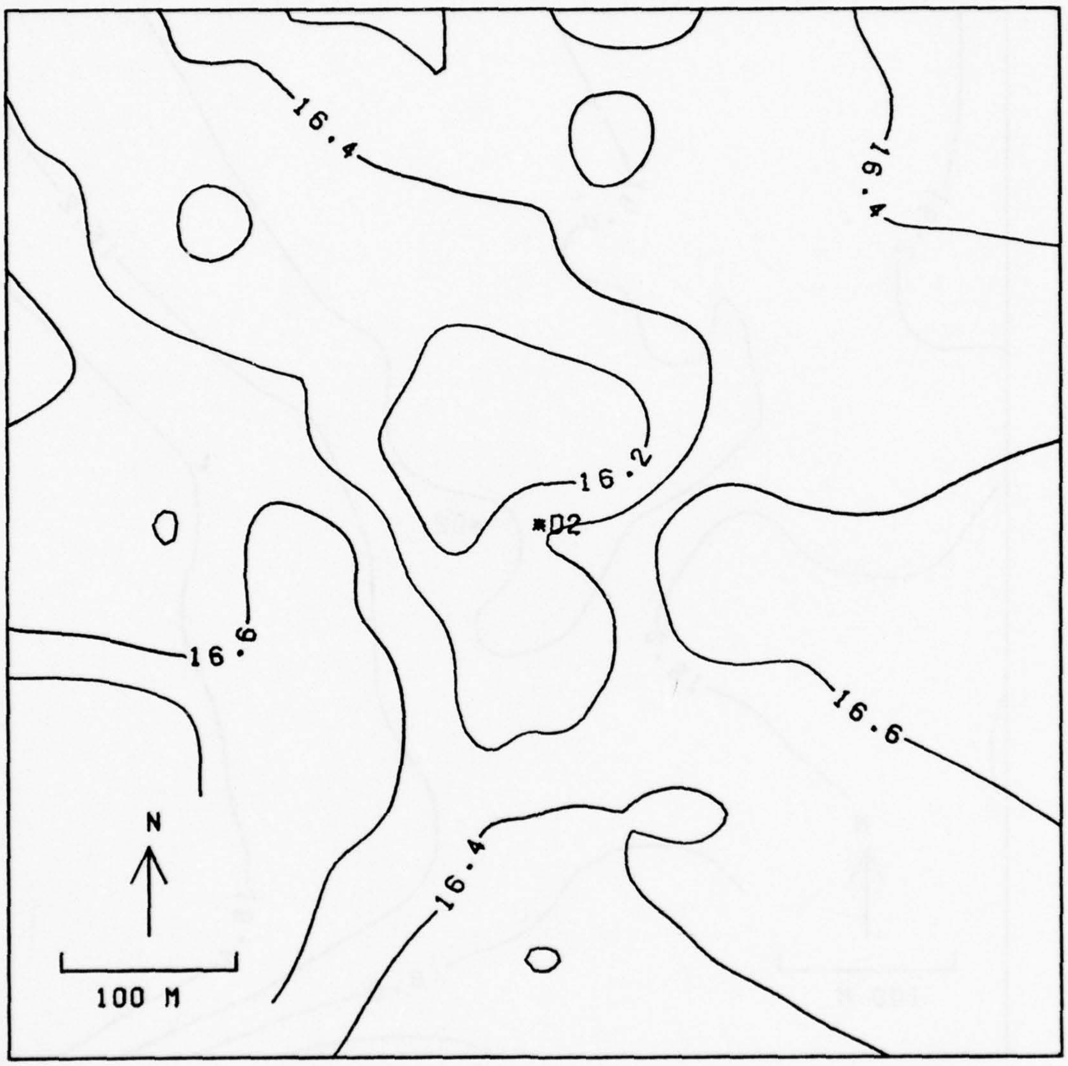


Figure B'4. Detailed bathymetry for 14 August 1975 on site D2

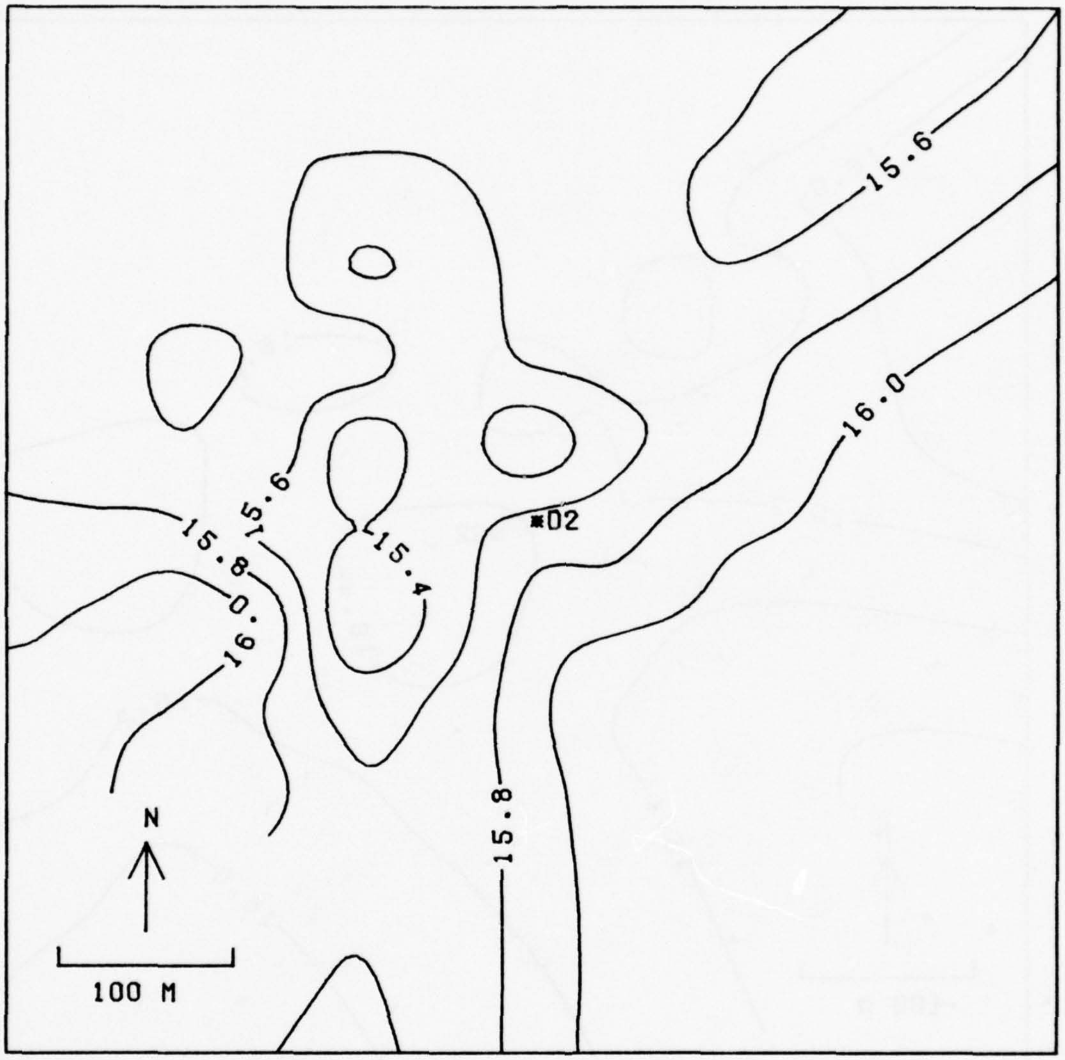


Figure B'5. Detailed bathymetry for November 1975 on site D2

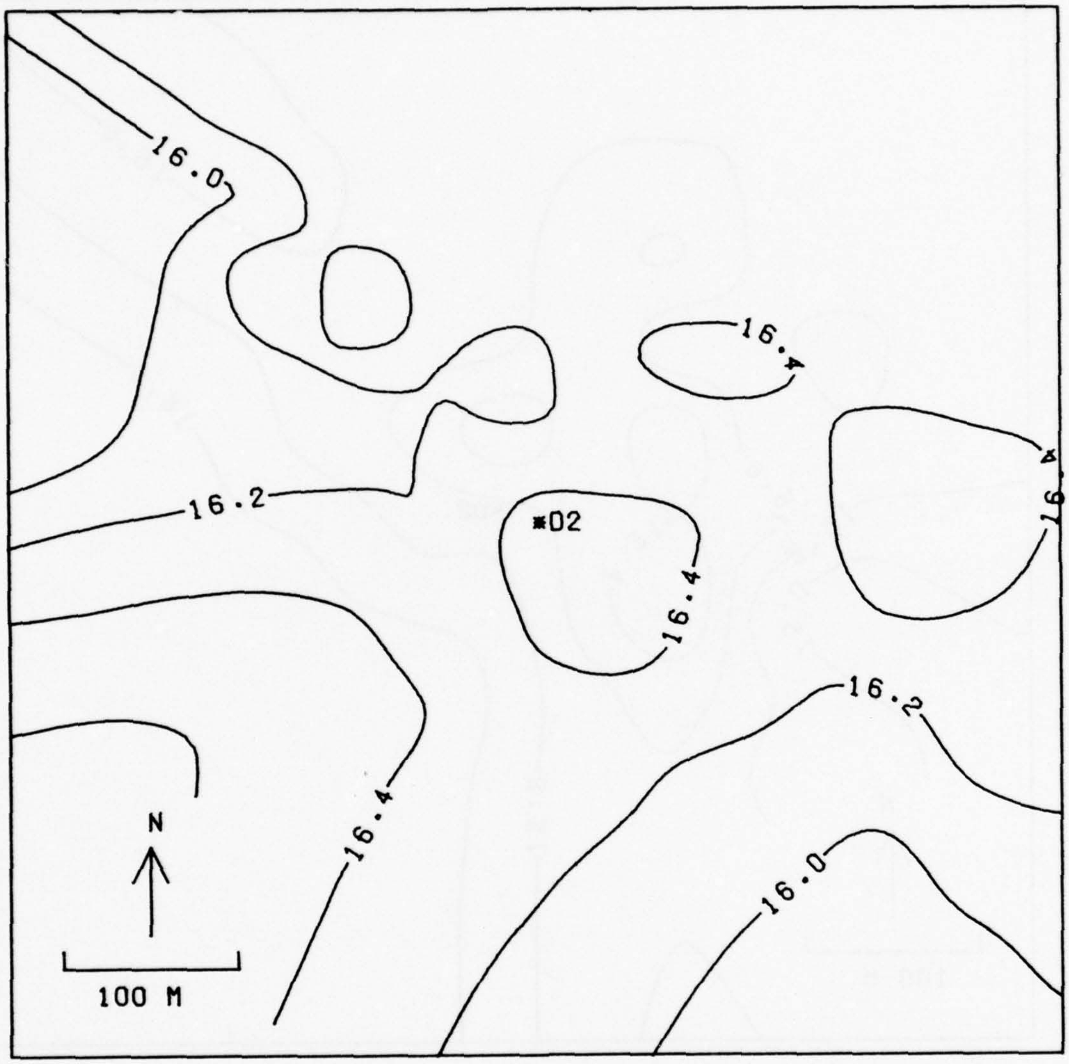


Figure B'6. Detailed bathymetry for March 1976 on site D2

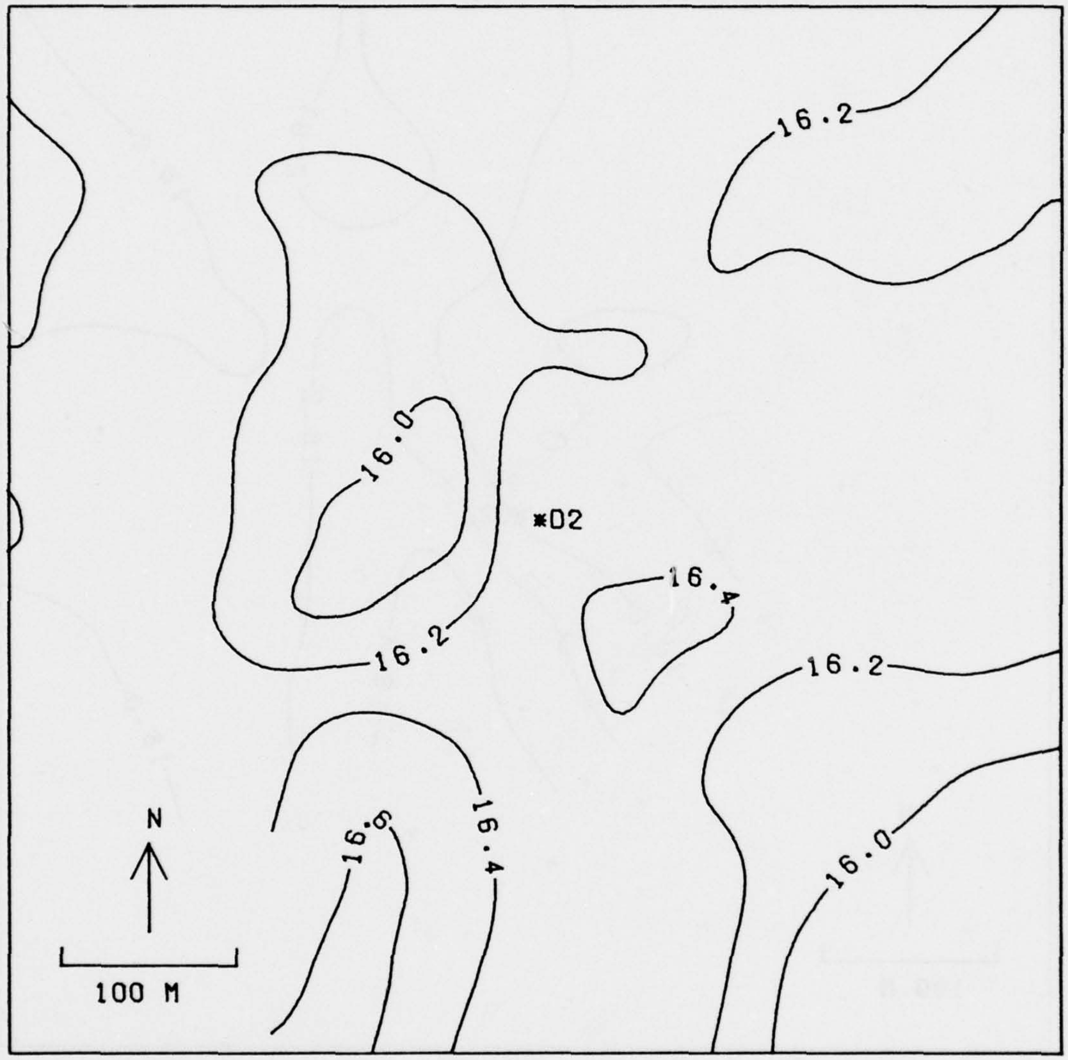


Figure B'7. Detailed bathymetry for April 1976 on site D2

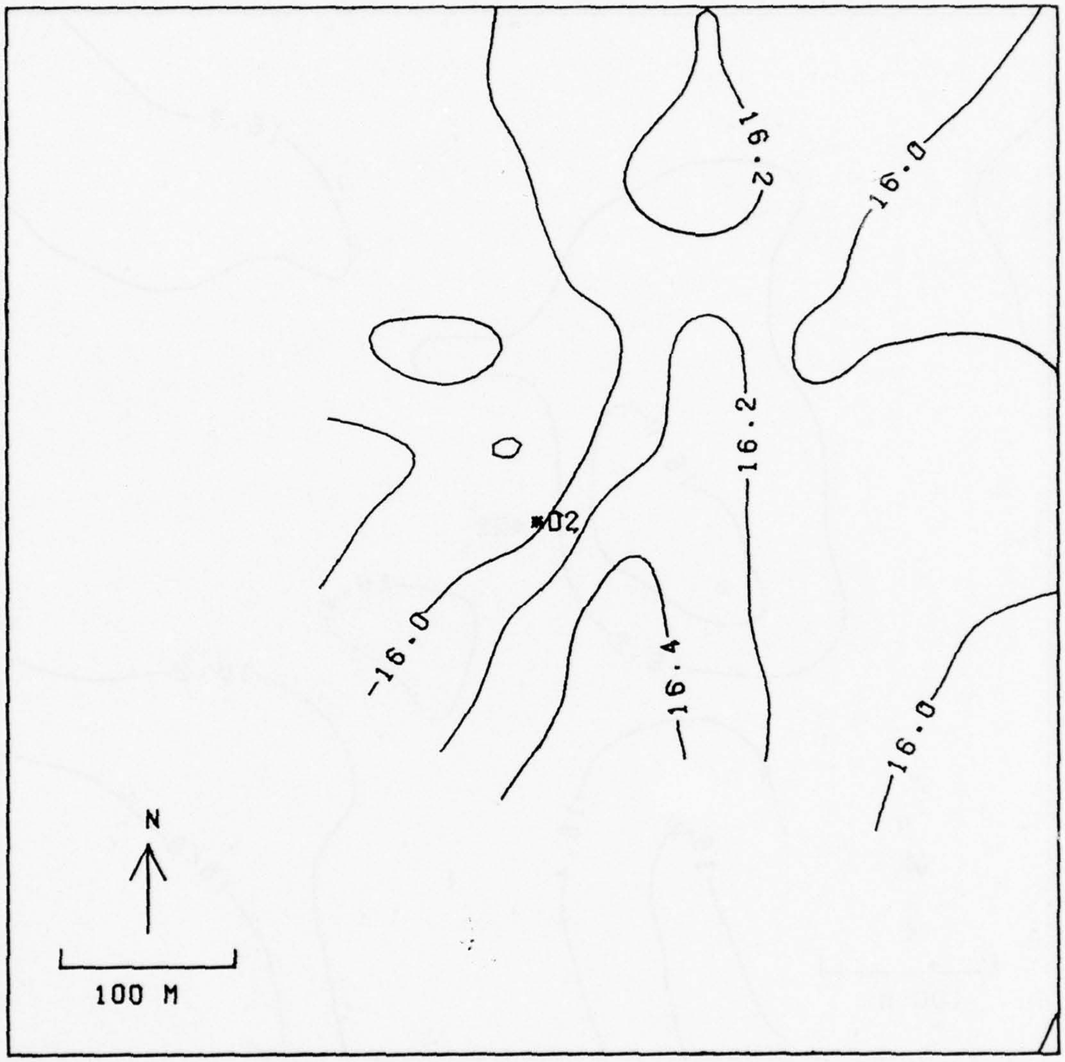


Figure B'8. Detailed bathymetry for May 1976 on
site D2

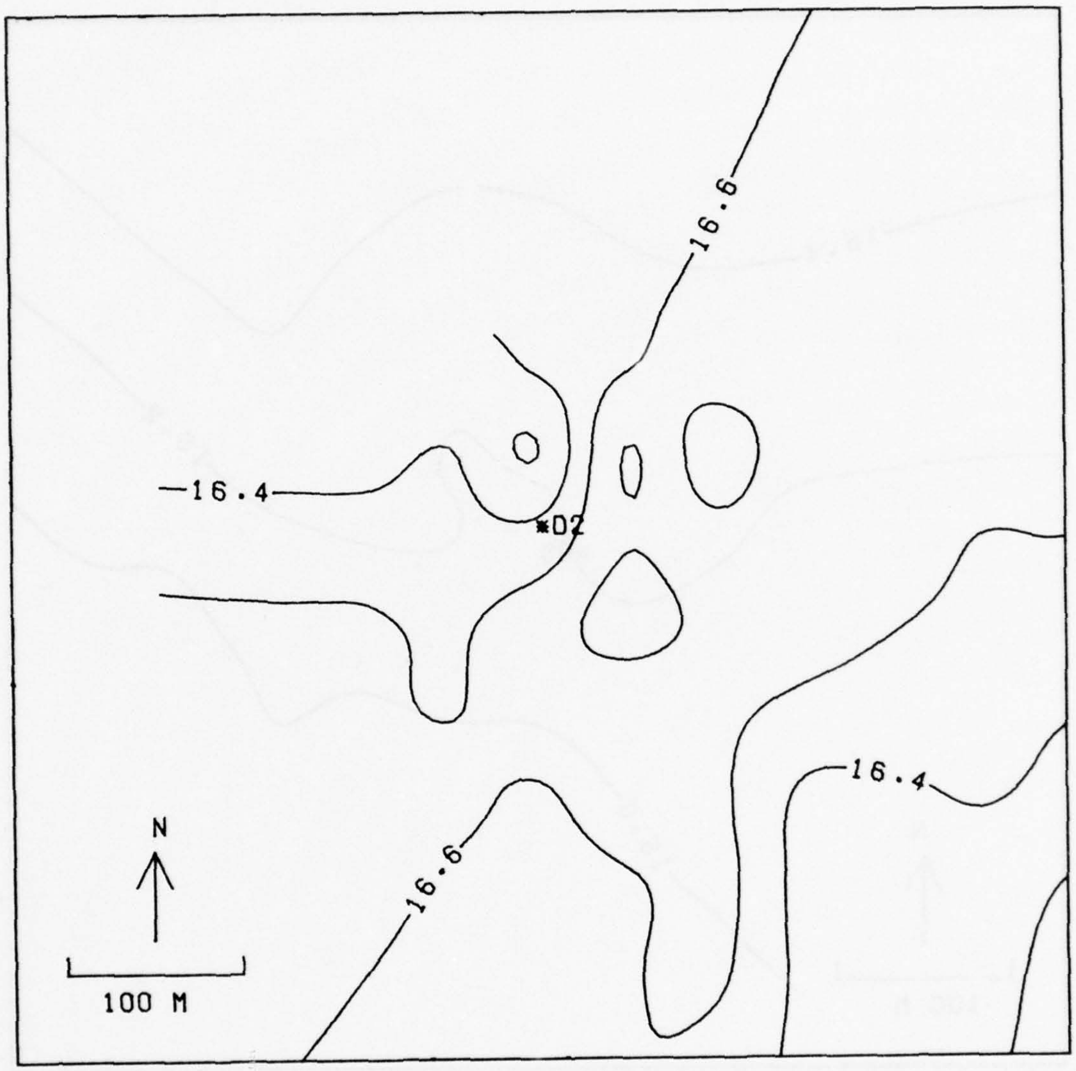


Figure B'9. Detailed bathymetry for June 1976 on
site D2

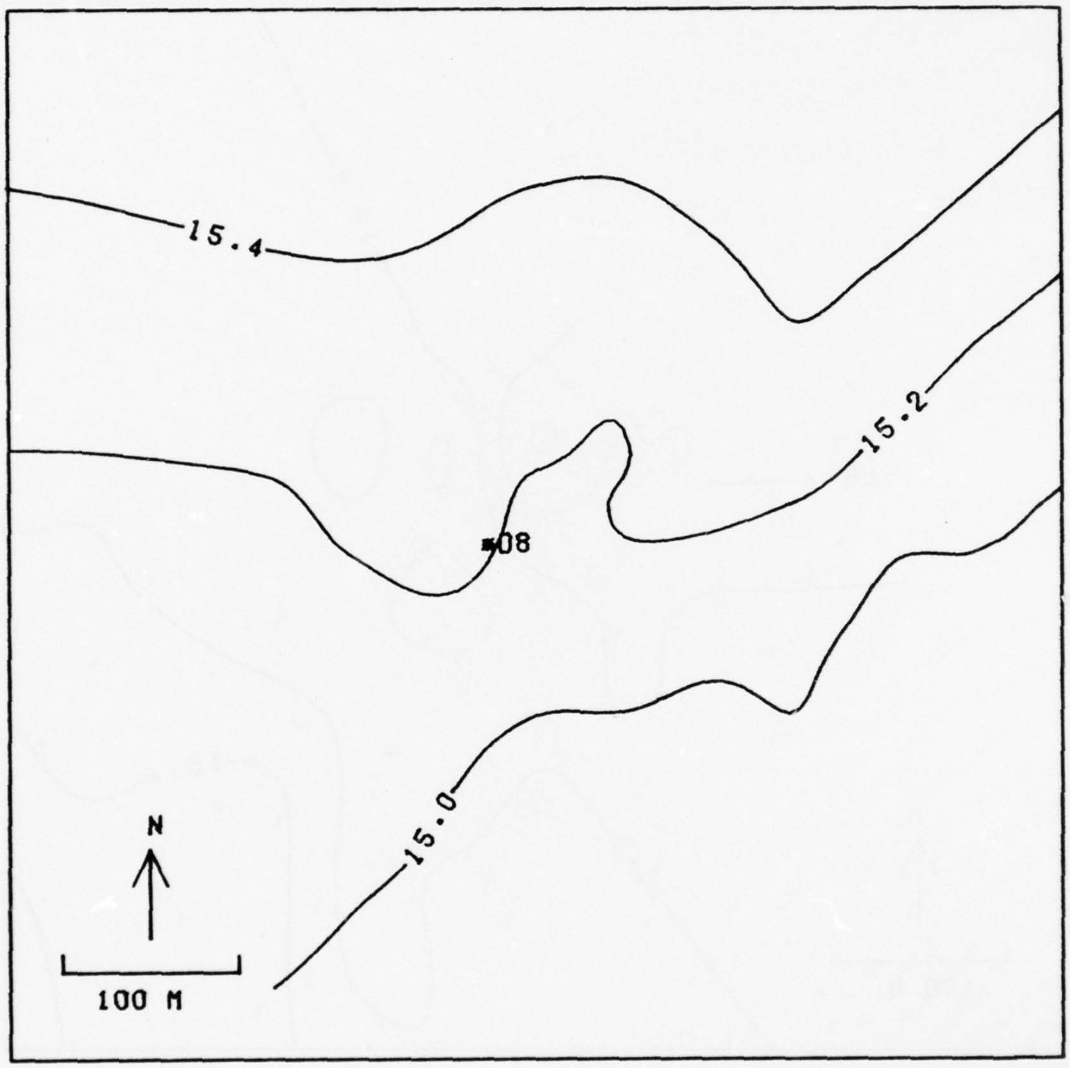


Figure B'10. Detailed bathymetry for 2 August 1975 on site D8

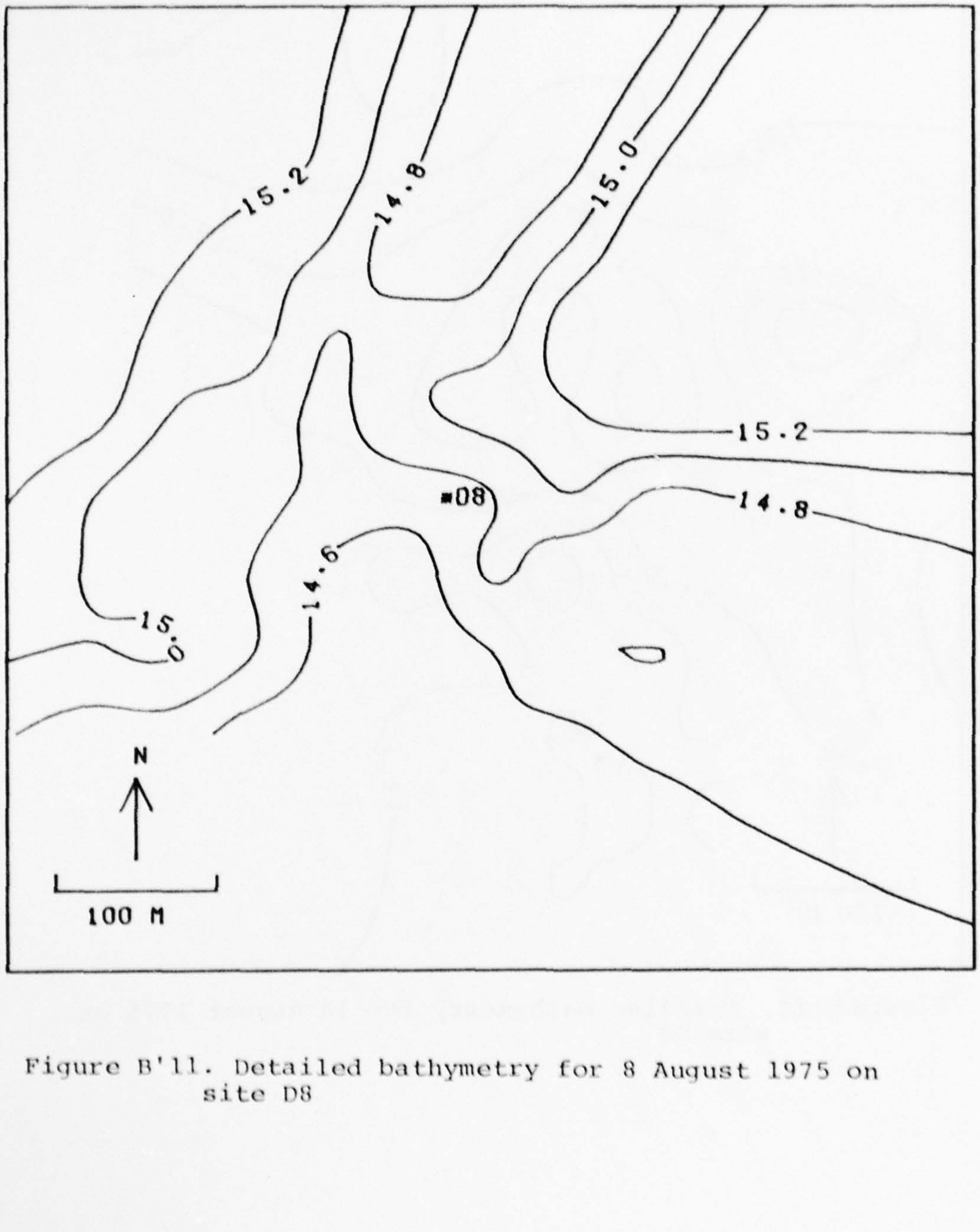


Figure B'11. Detailed bathymetry for 8 August 1975 on site D8

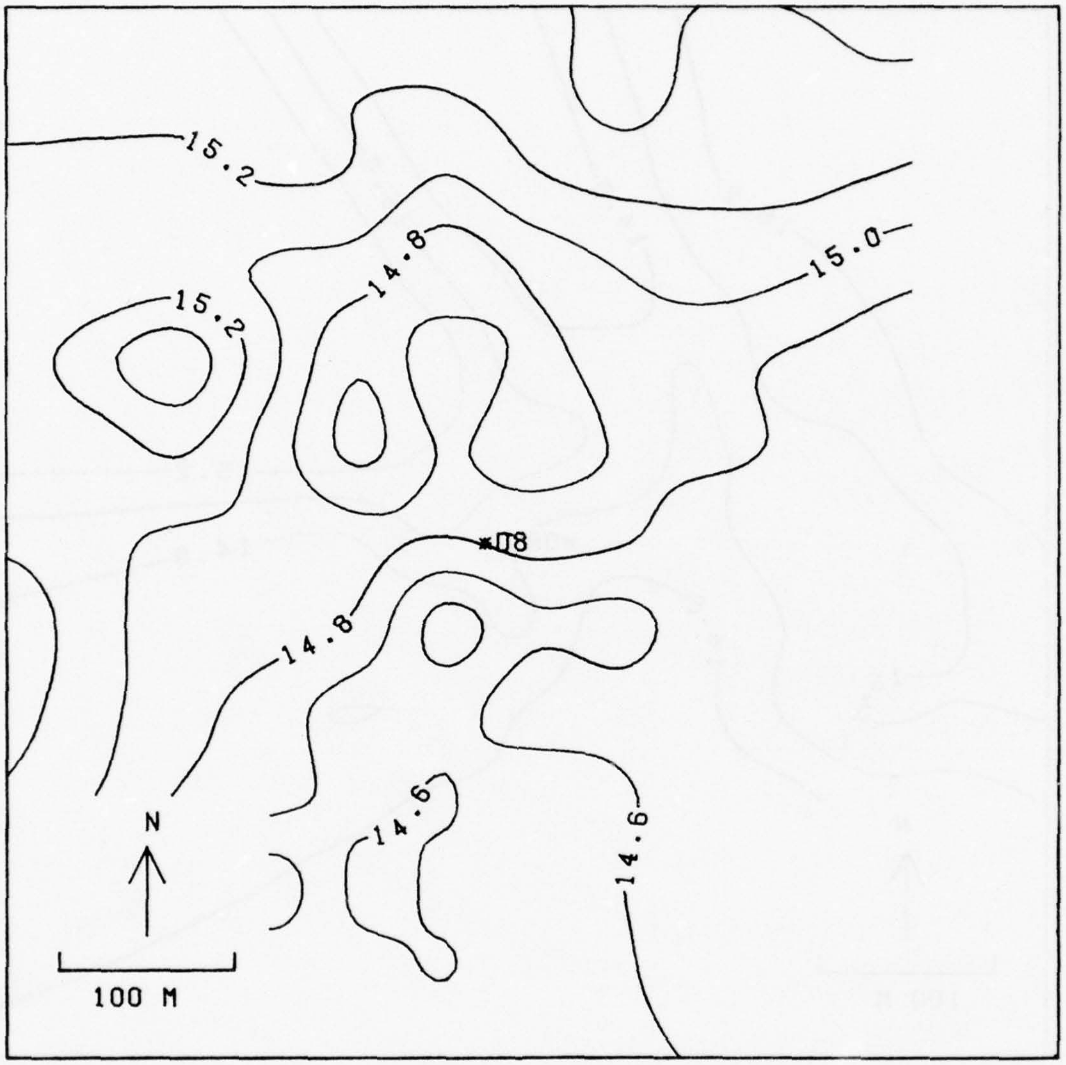


Figure B'12. Detailed bathymetry for 14 August 1975 on site D8

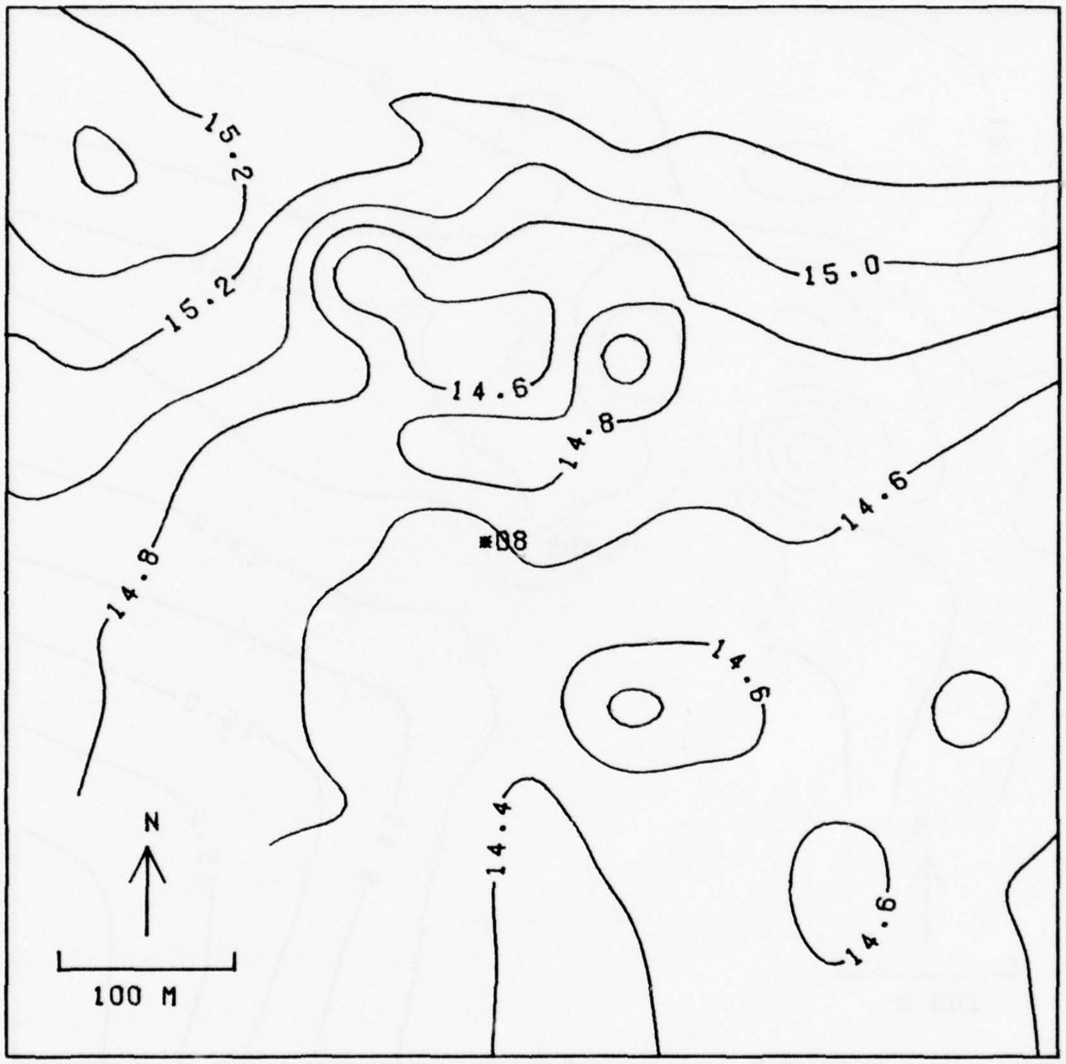


Figure B'13. Detailed bathymetry for 15 August 1975 on site D8

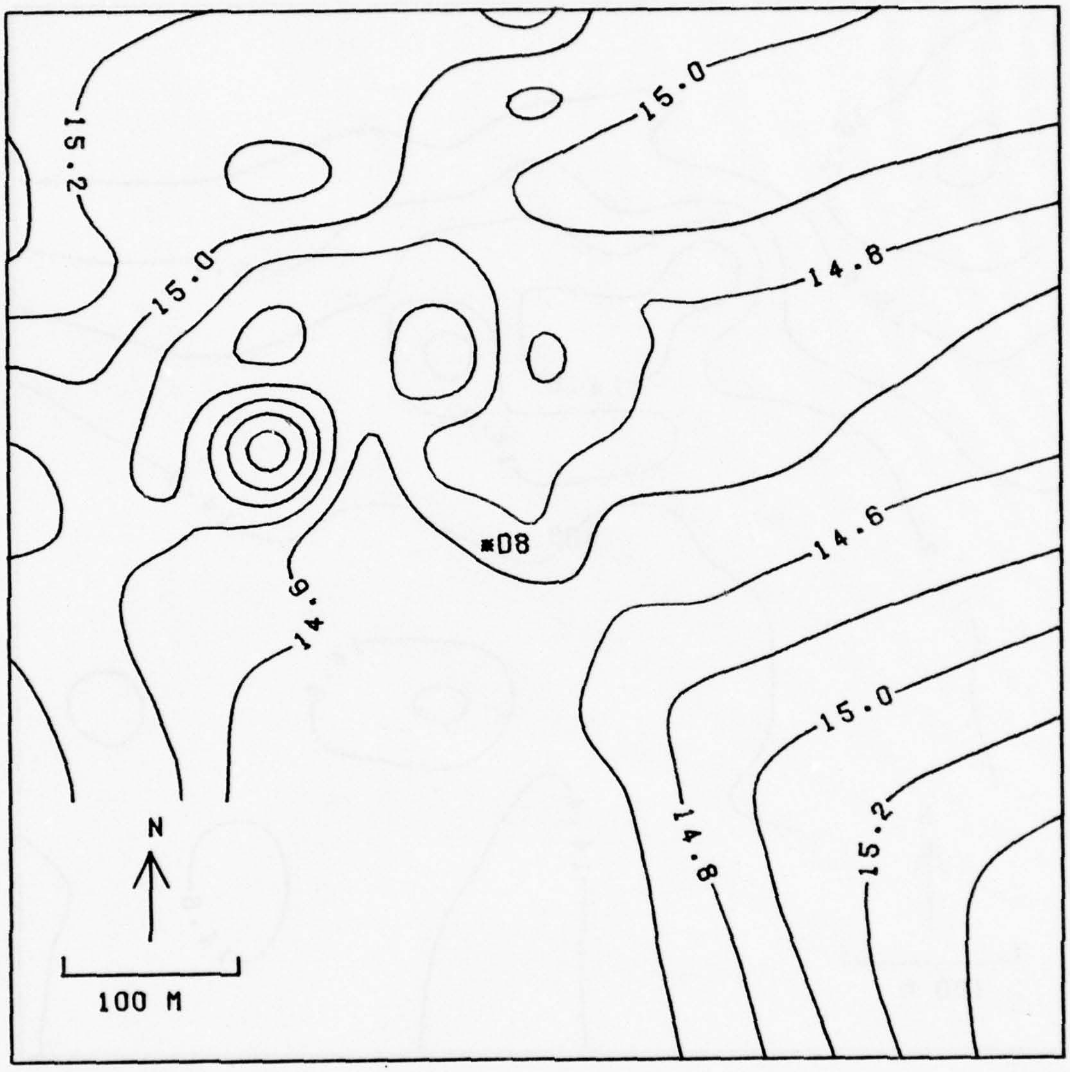


Figure B'14. Detailed bathymetry for September 1975 on site D8

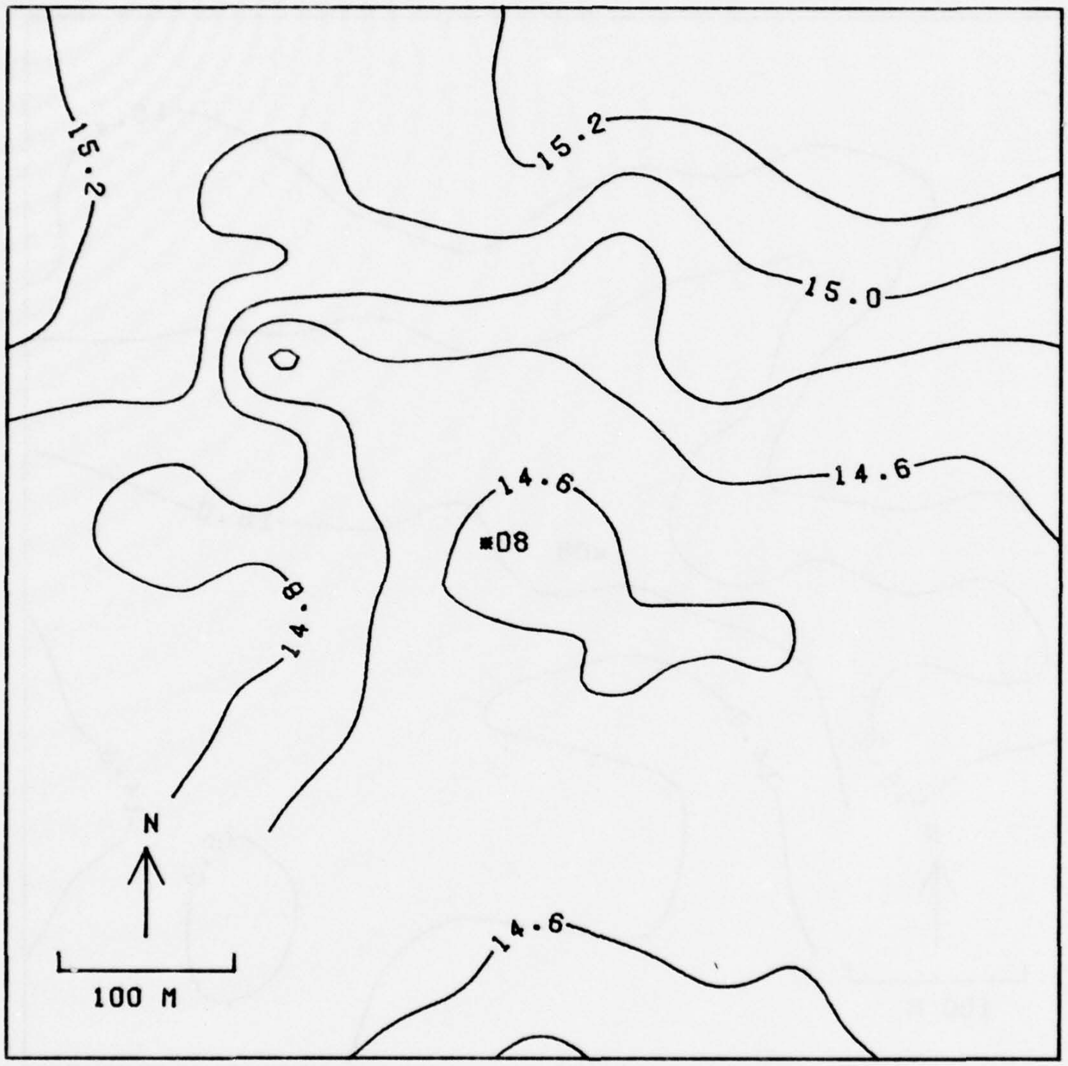


Figure B'15. Detailed bathymetry for November 1975 on site D8

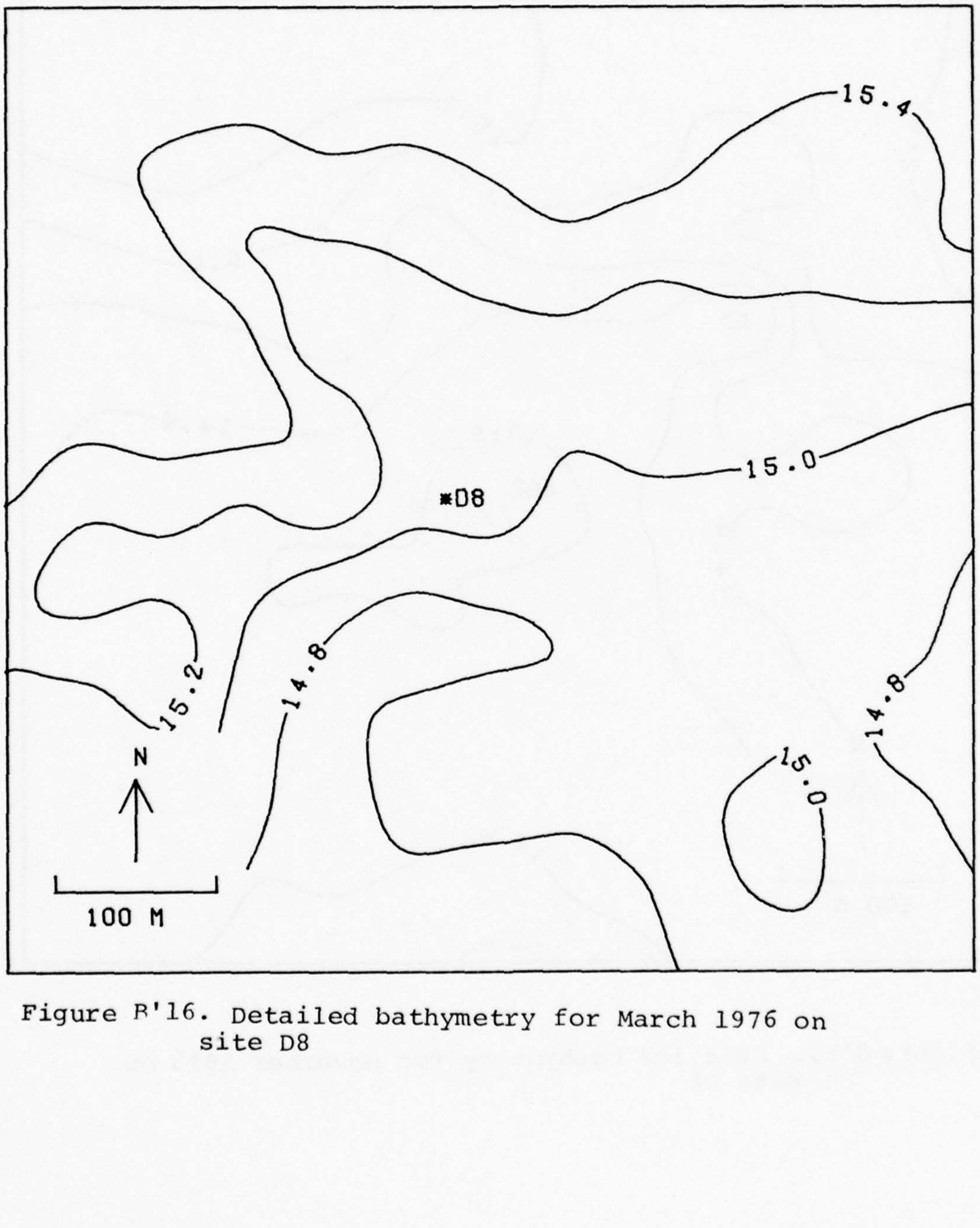


Figure B'16. Detailed bathymetry for March 1976 on site D8

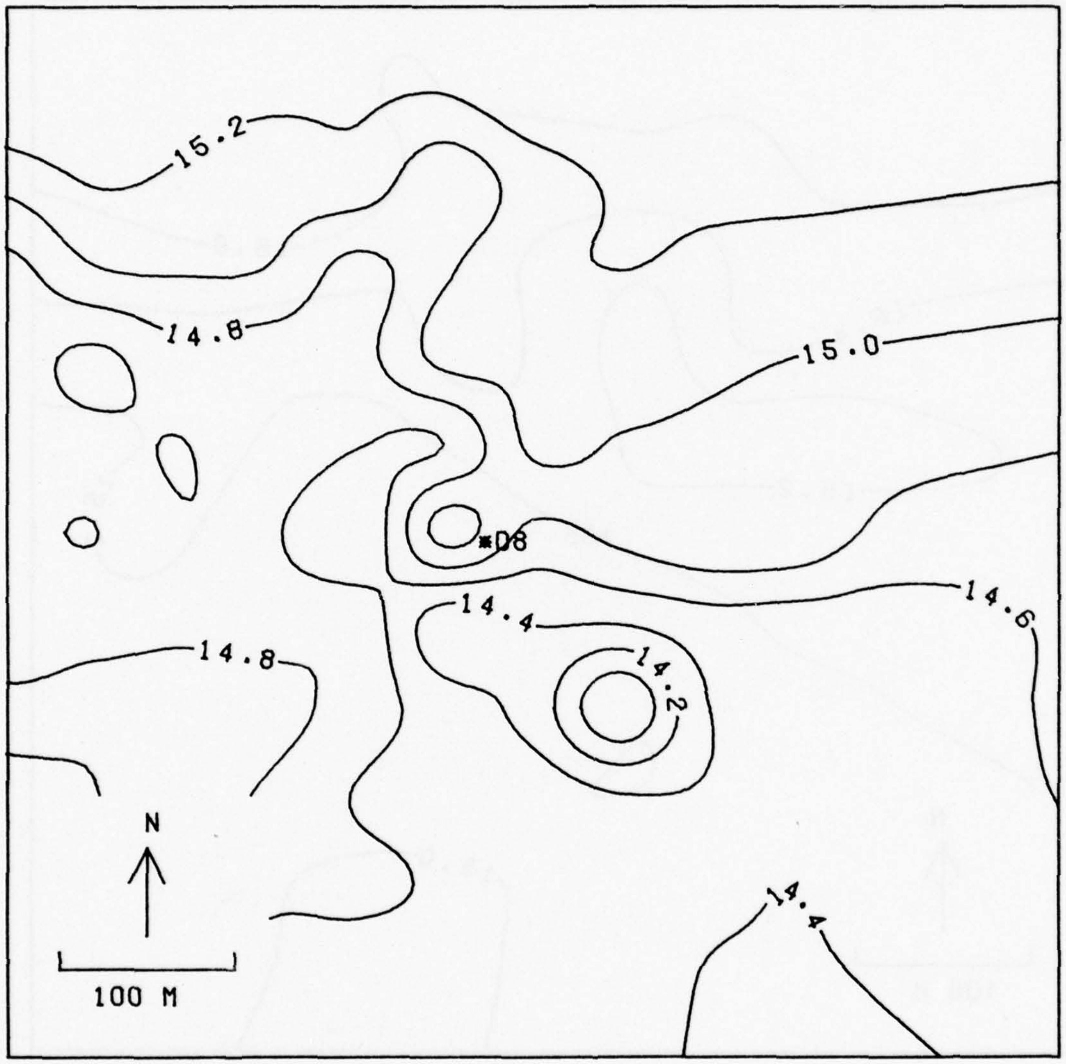


Figure B'17. Detailed bathymetry for April 1976 on
site D8

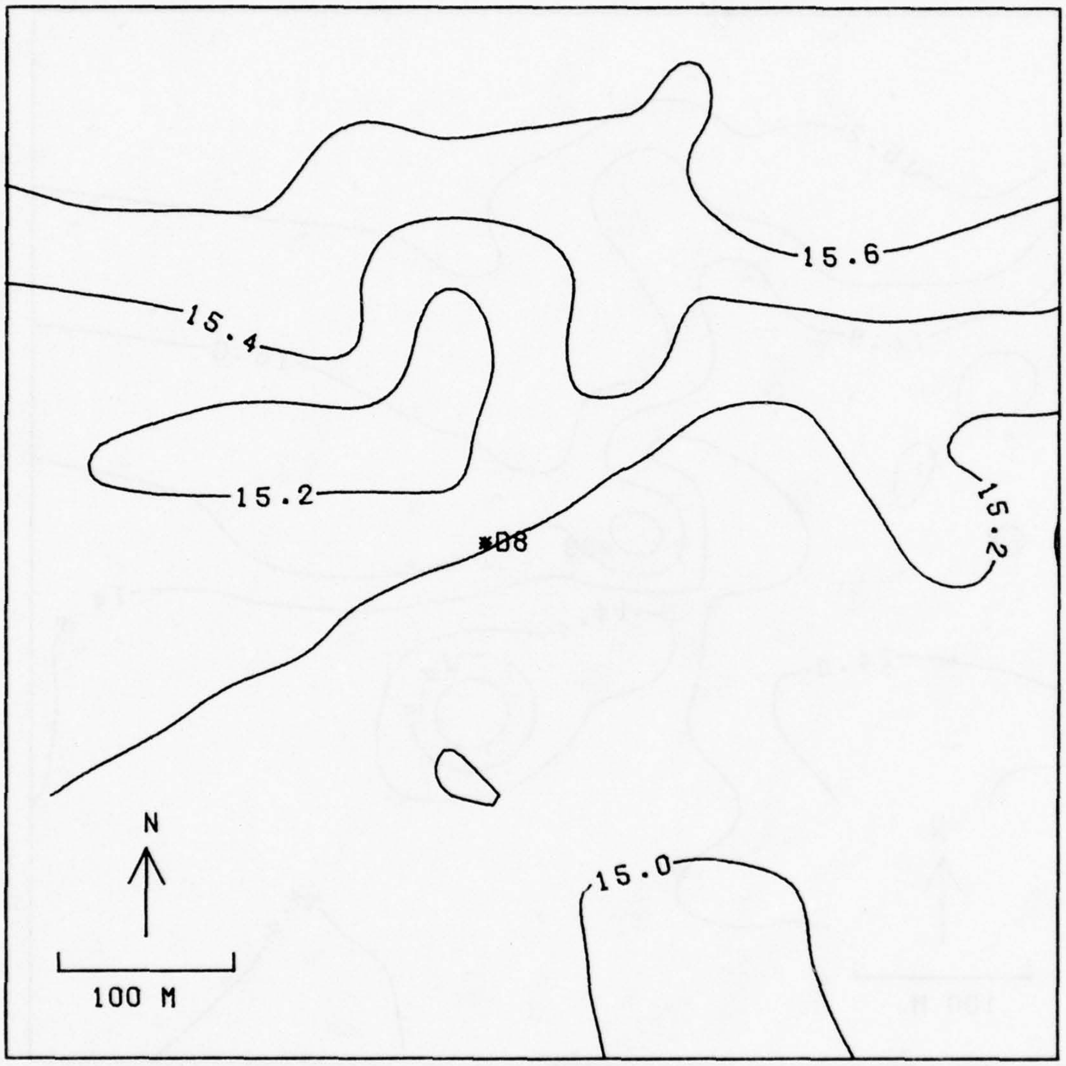


Figure B'18. Detailed bathymetry for June 1976 on site D8

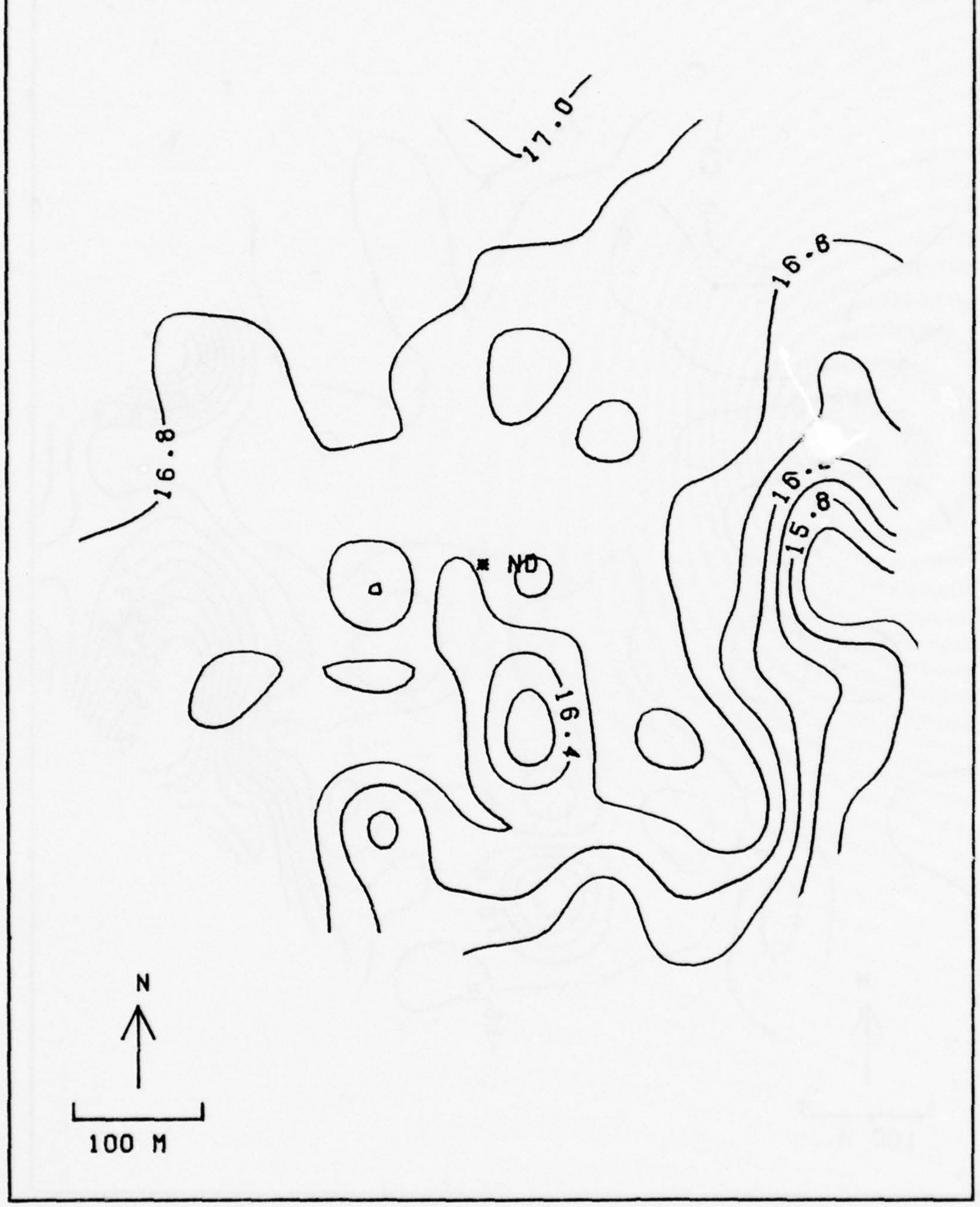


Figure B'19. Detailed bathymetry for 14 May 1976 on site ND

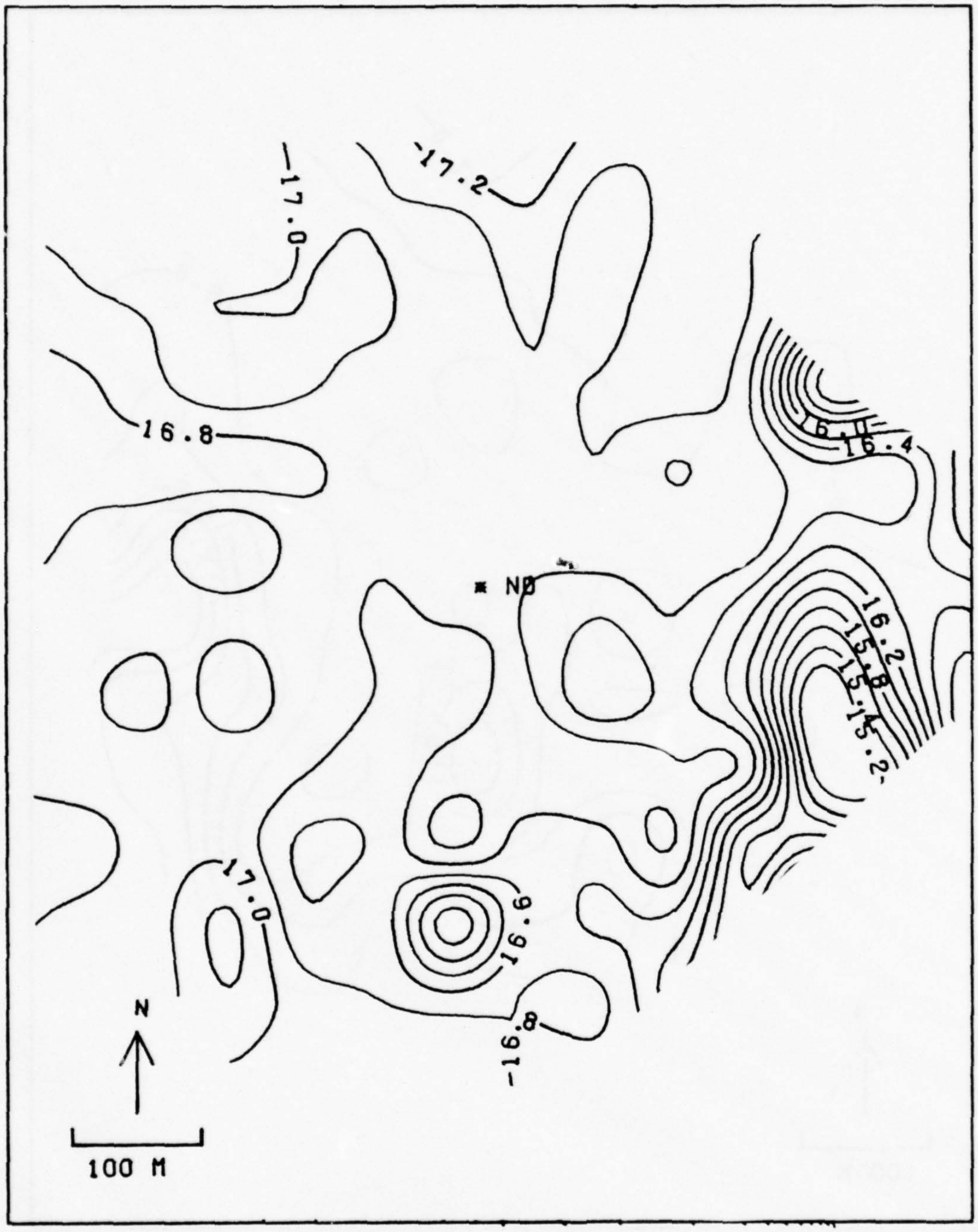


Figure B'20. Detailed bathymetry for 27 May 1976 on site ND

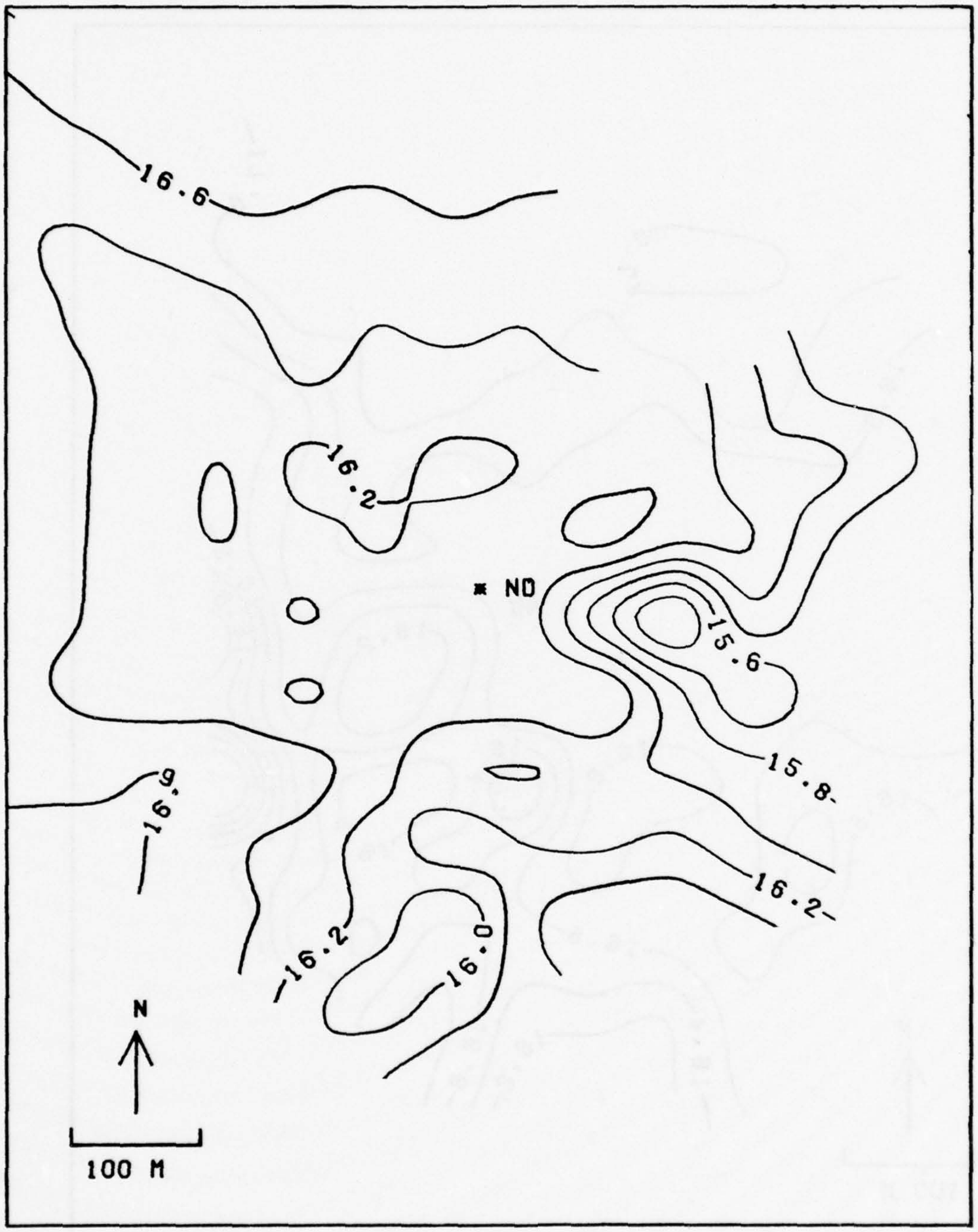


Figure B'21. Detailed bathymetry for July 1976 on site ND

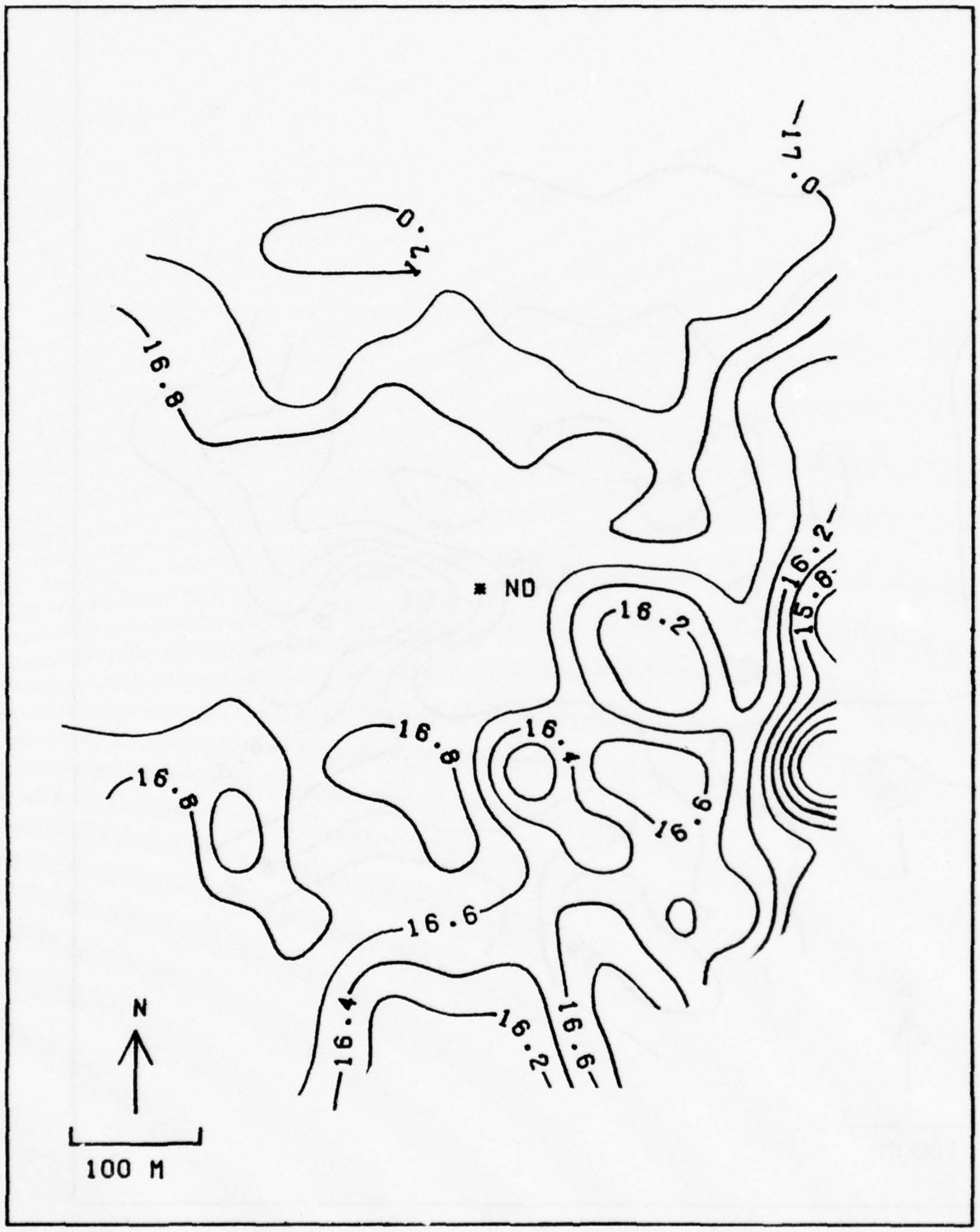


Figure B'22. Detailed bathymetry for September 1976 on site ND

APPENDIX C': SPEED-DIRECTION PLOTS AND PROGRESSIVE VECTOR PLOTS FOR THE CURRENTS

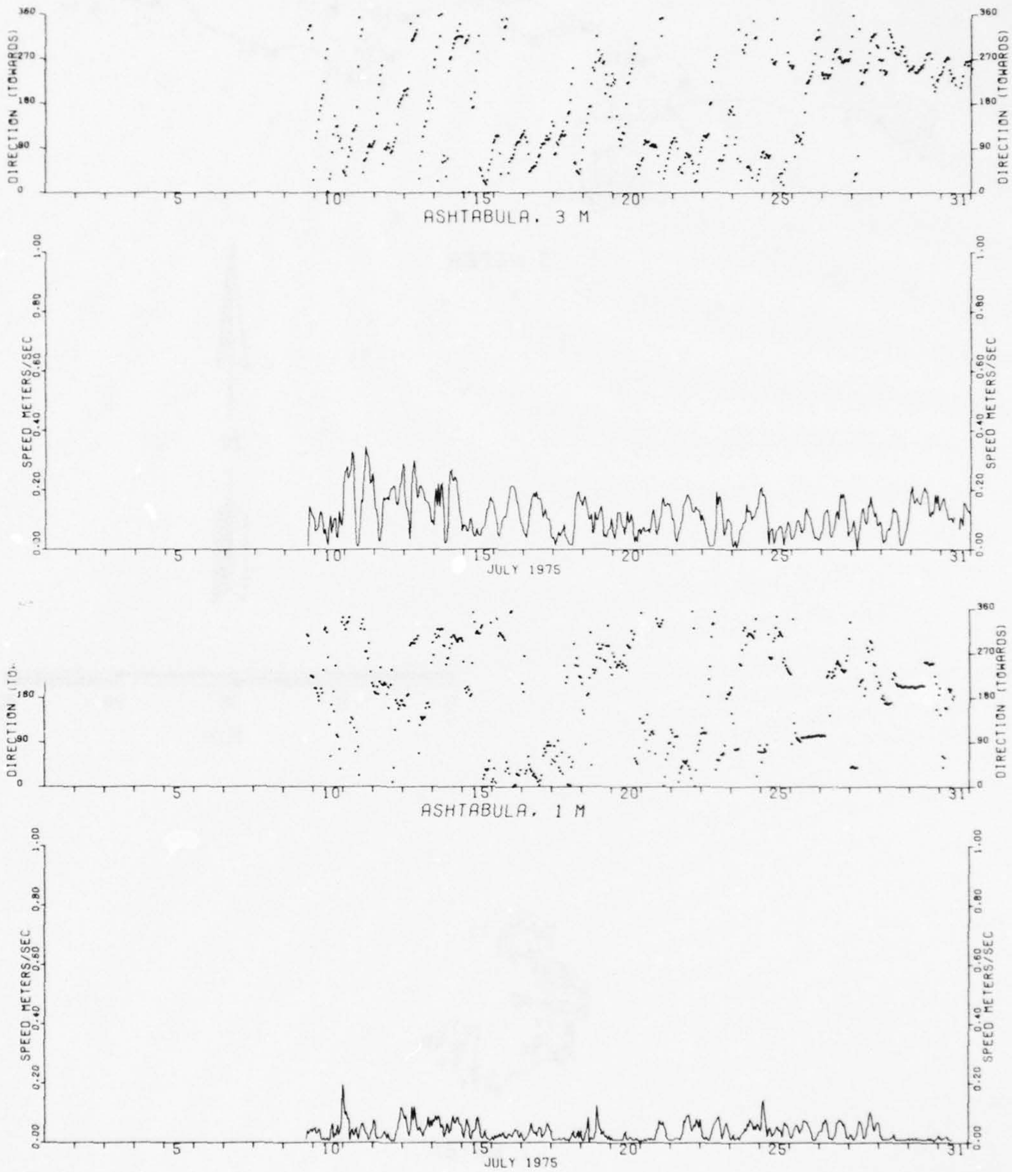


Figure C'1. Time continuous current speed and direction recorded at a height of 1 and 3 m above the lake bottom at station PC1 for July 1975

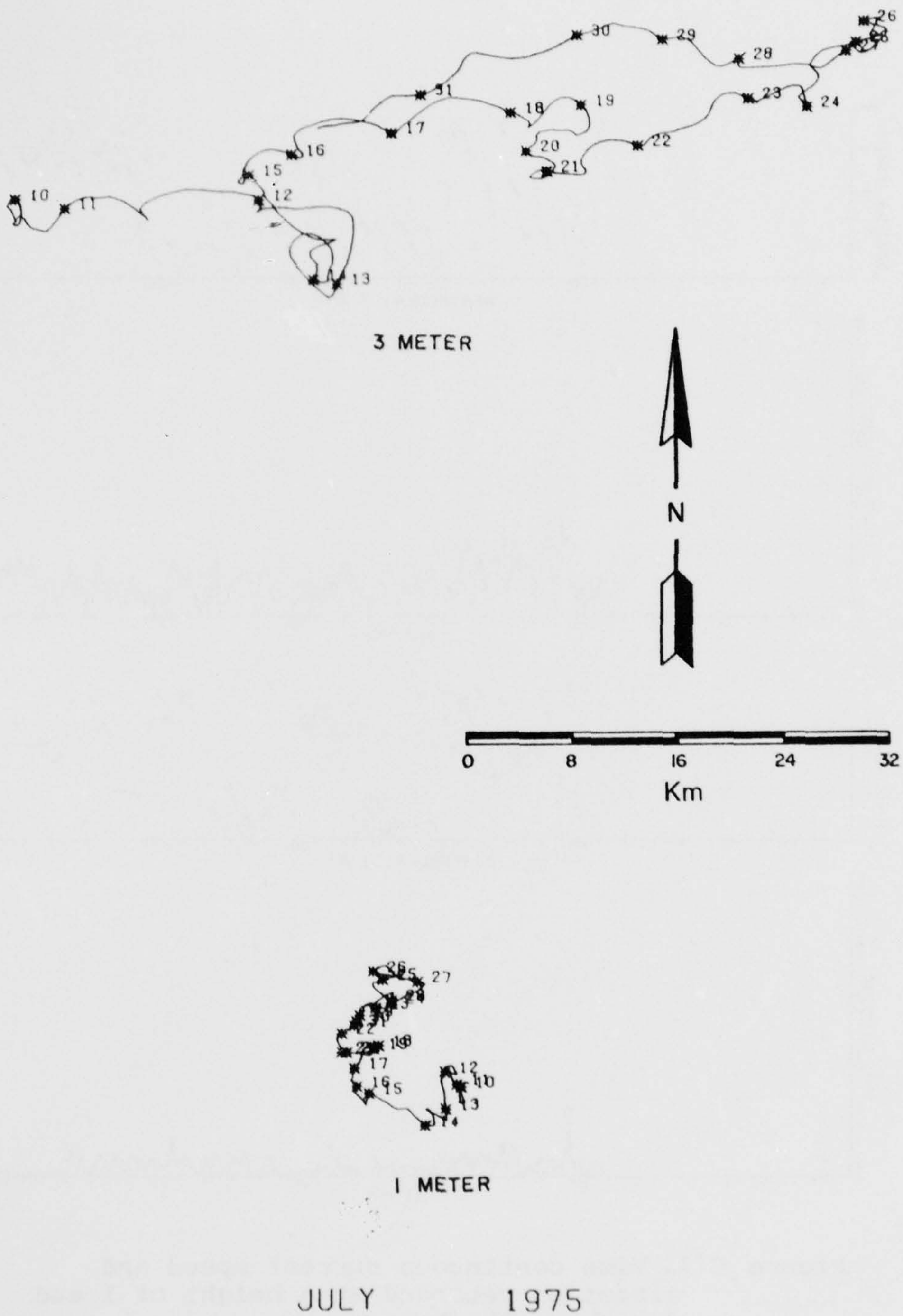


Figure C'2. Progressive vector plots of the currents for July 1975

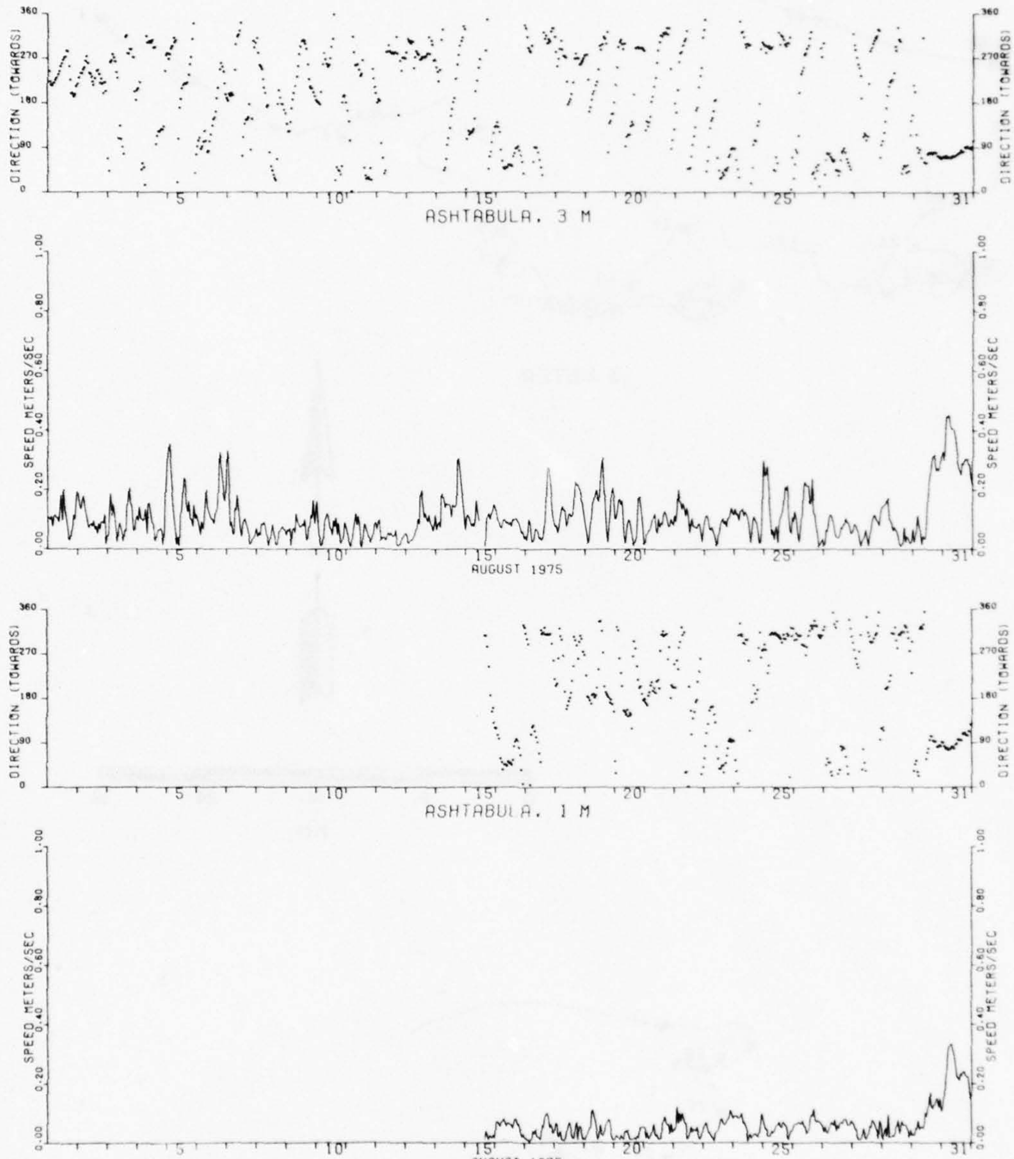


Figure C'3. Current speed and direction plots for August 1975

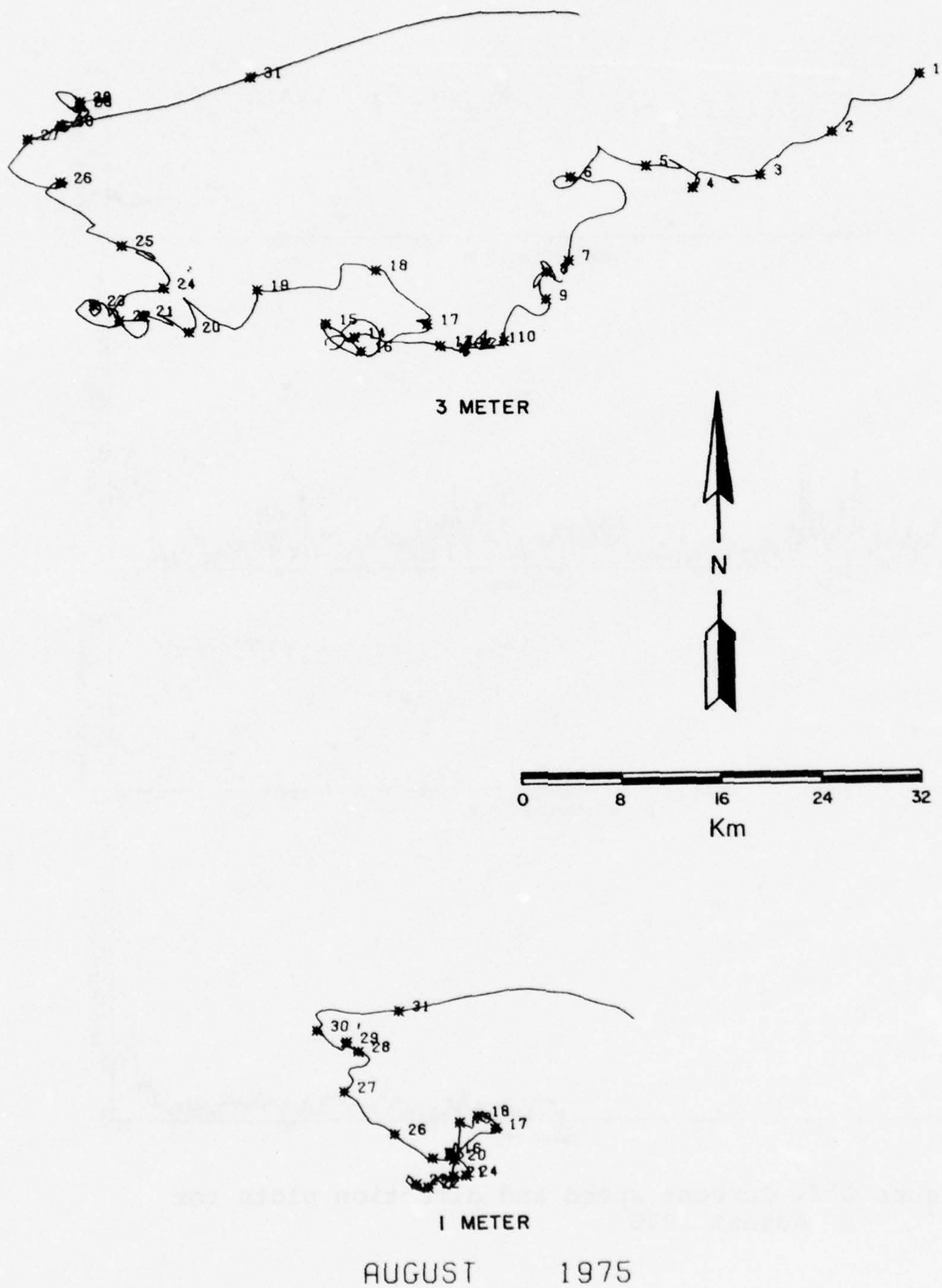


Figure C'4. Progressive vector plots of the currents for August 1975.

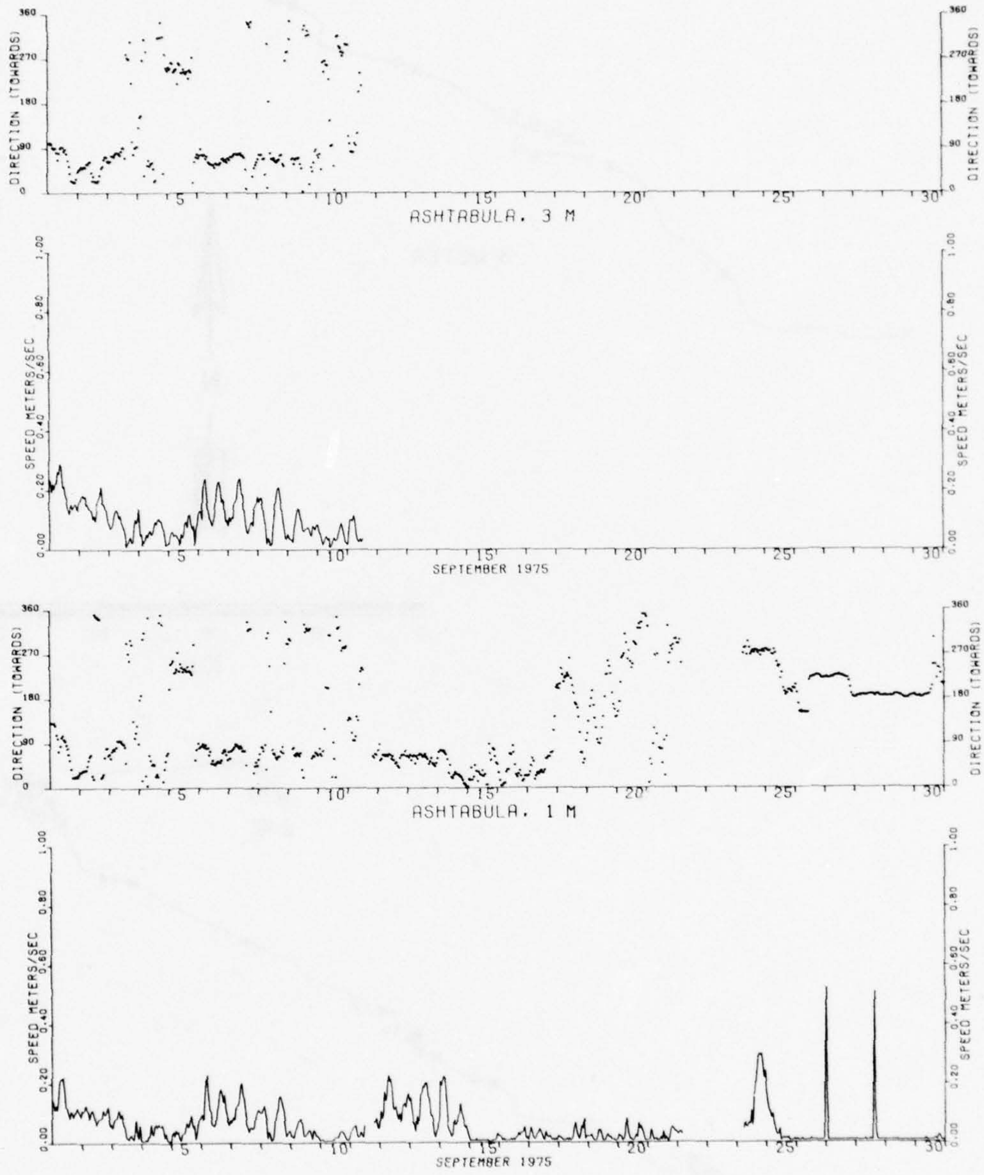


Figure C'5. Current speed and direction plots for September 1975

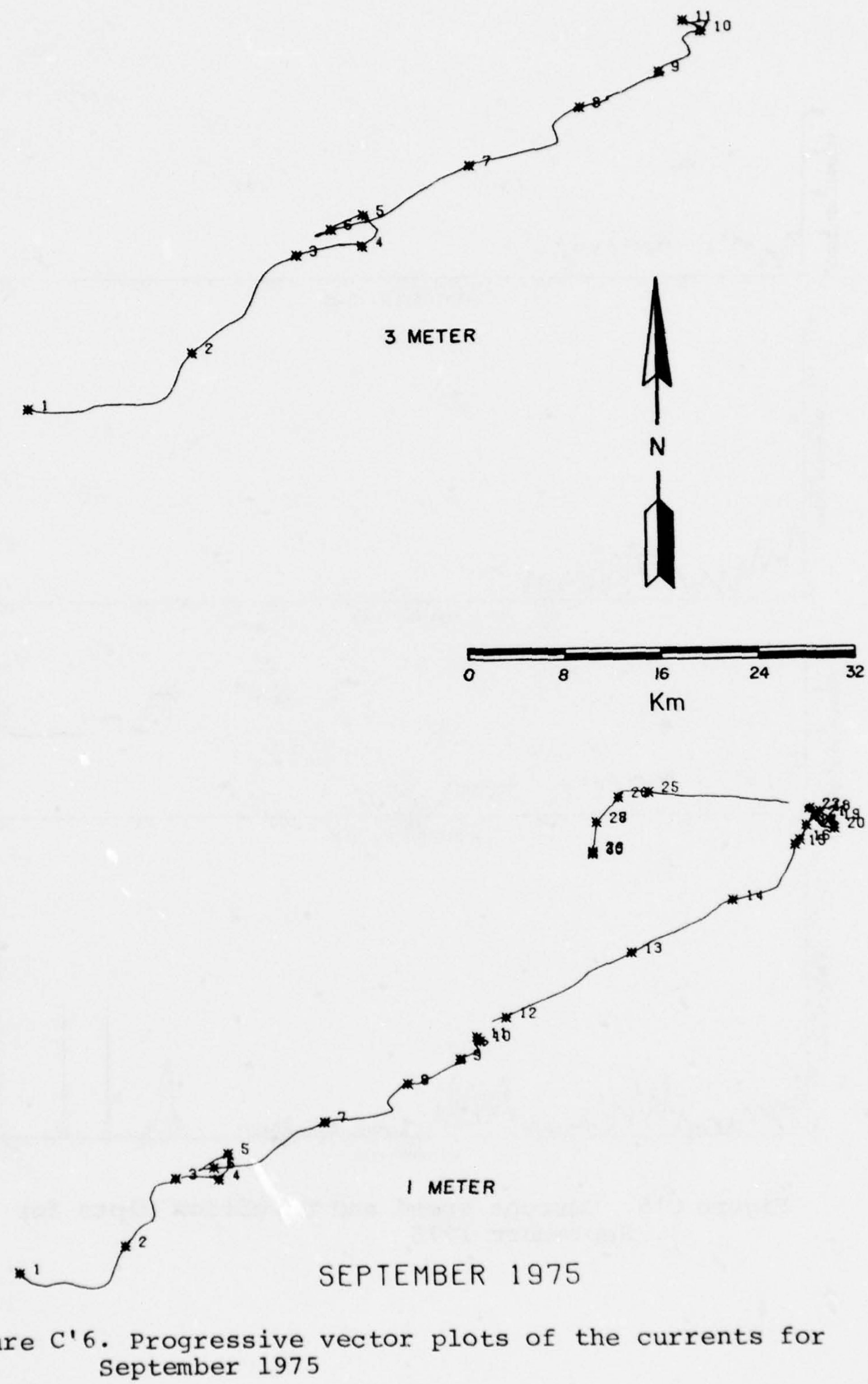


Figure C'6. Progressive vector plots of the currents for September 1975

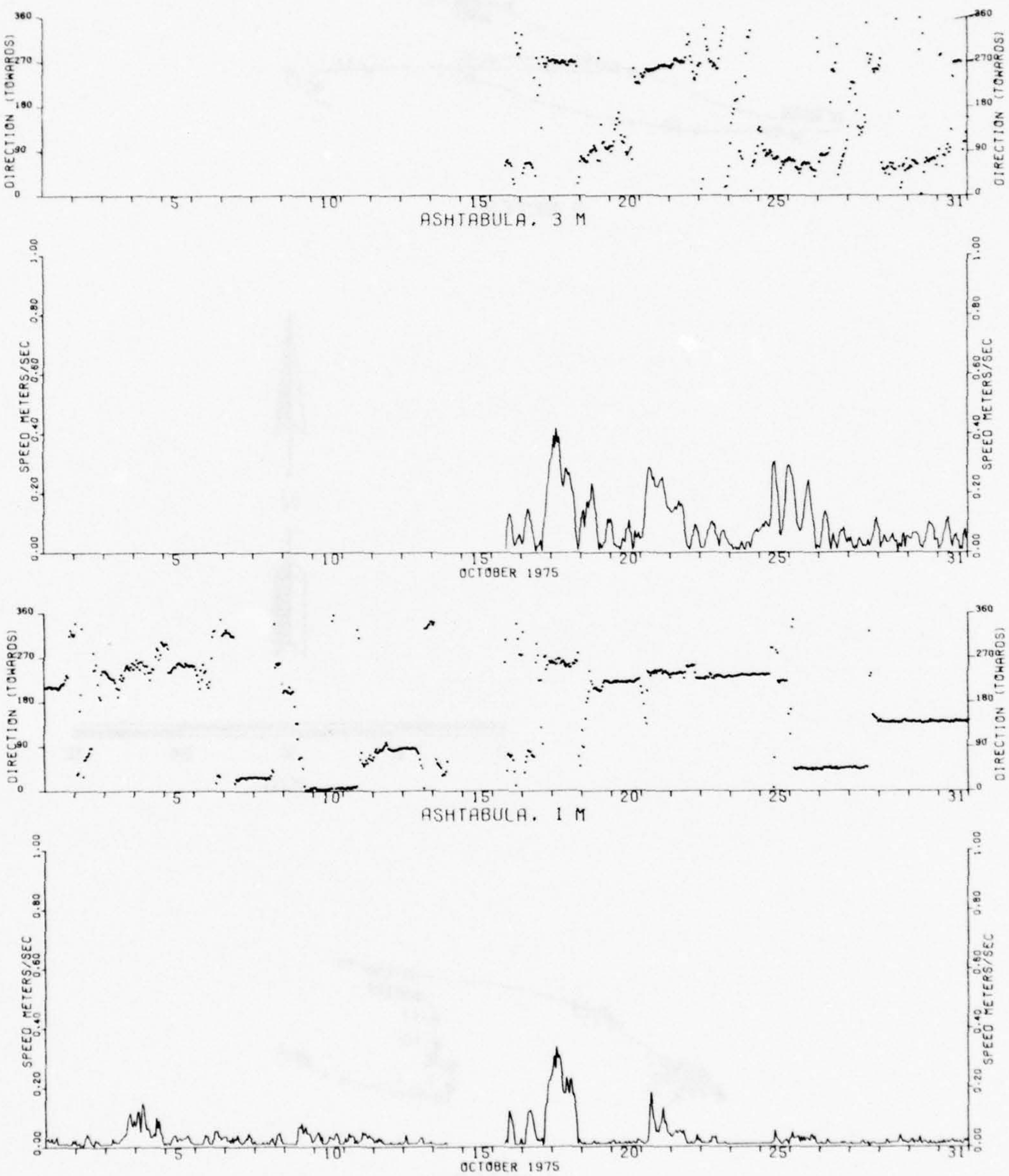
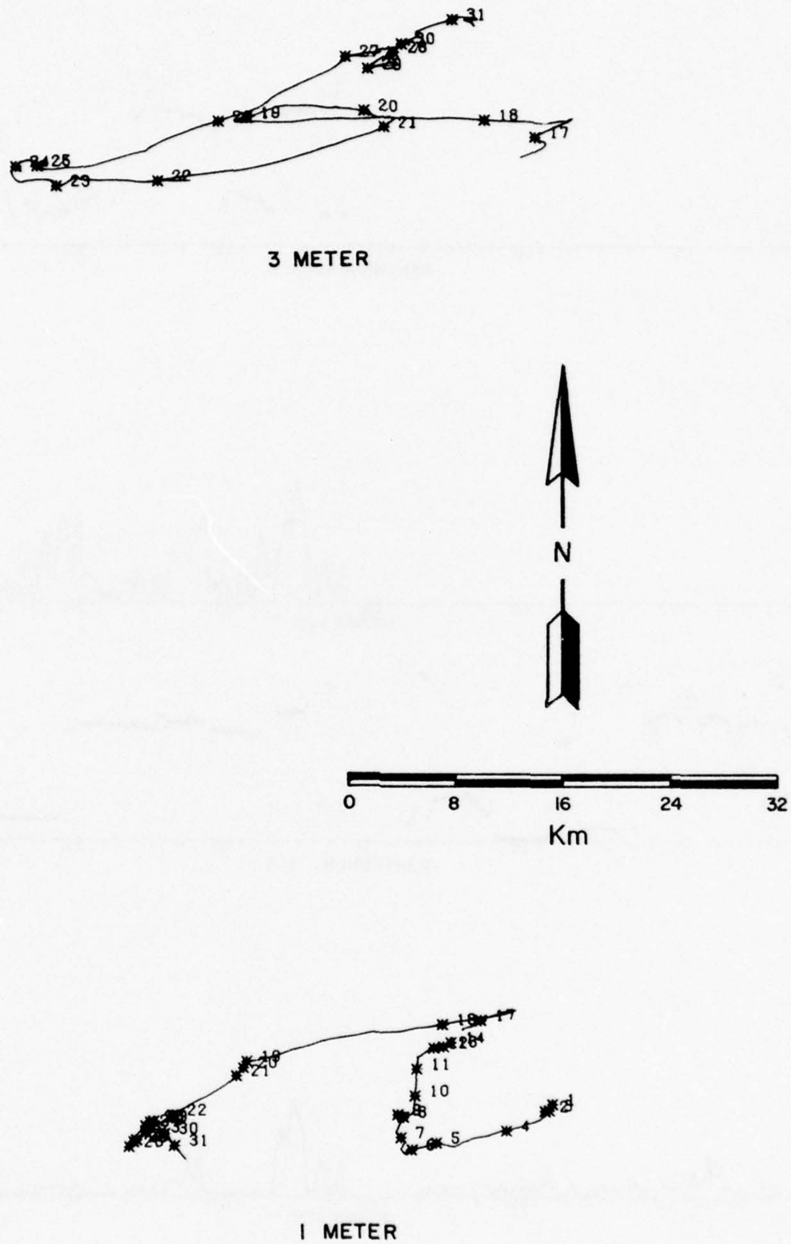


Figure C'7. Current speed and direction plots for October 1975



OCTOBER 1975

Figure C'8. Progressive vector plots of the currents for October 1975

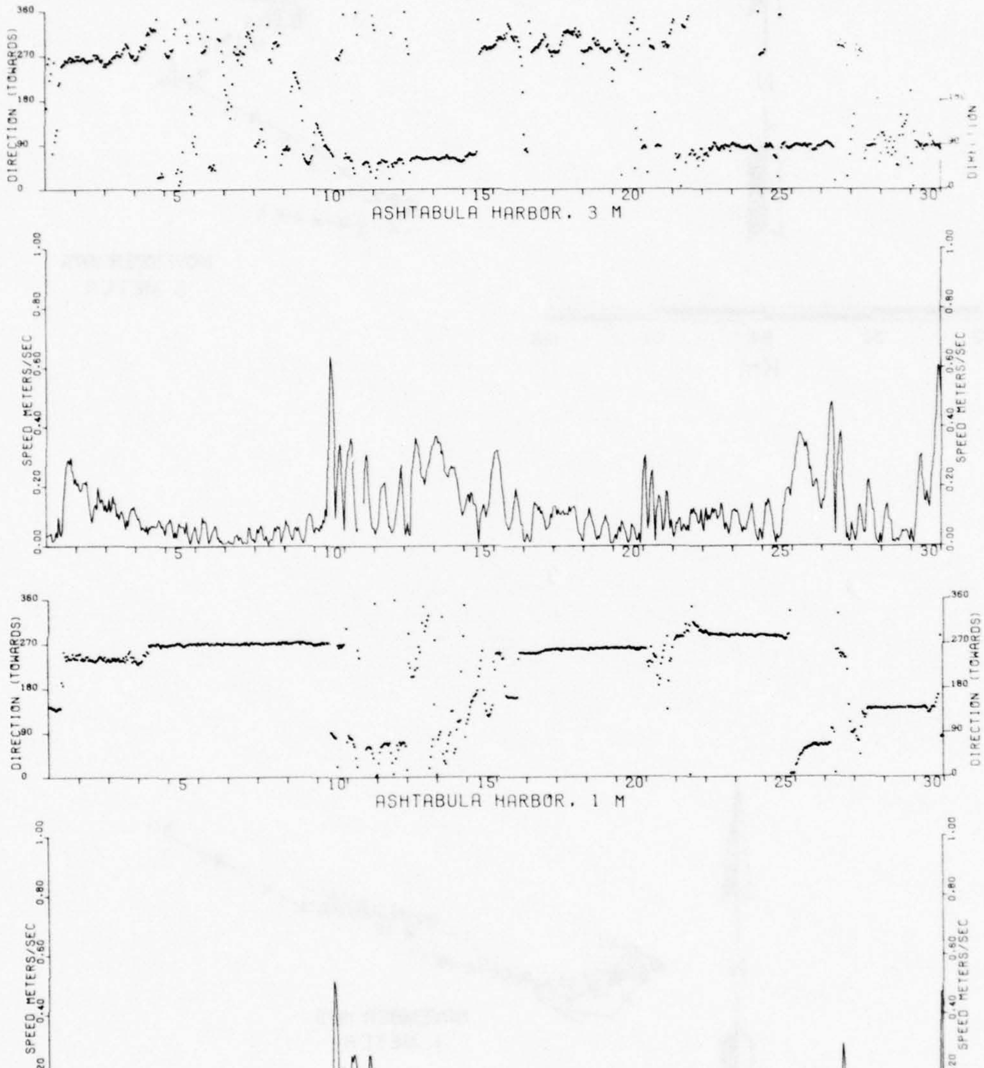


Figure C'9. Current speed and direction plots for November 1975

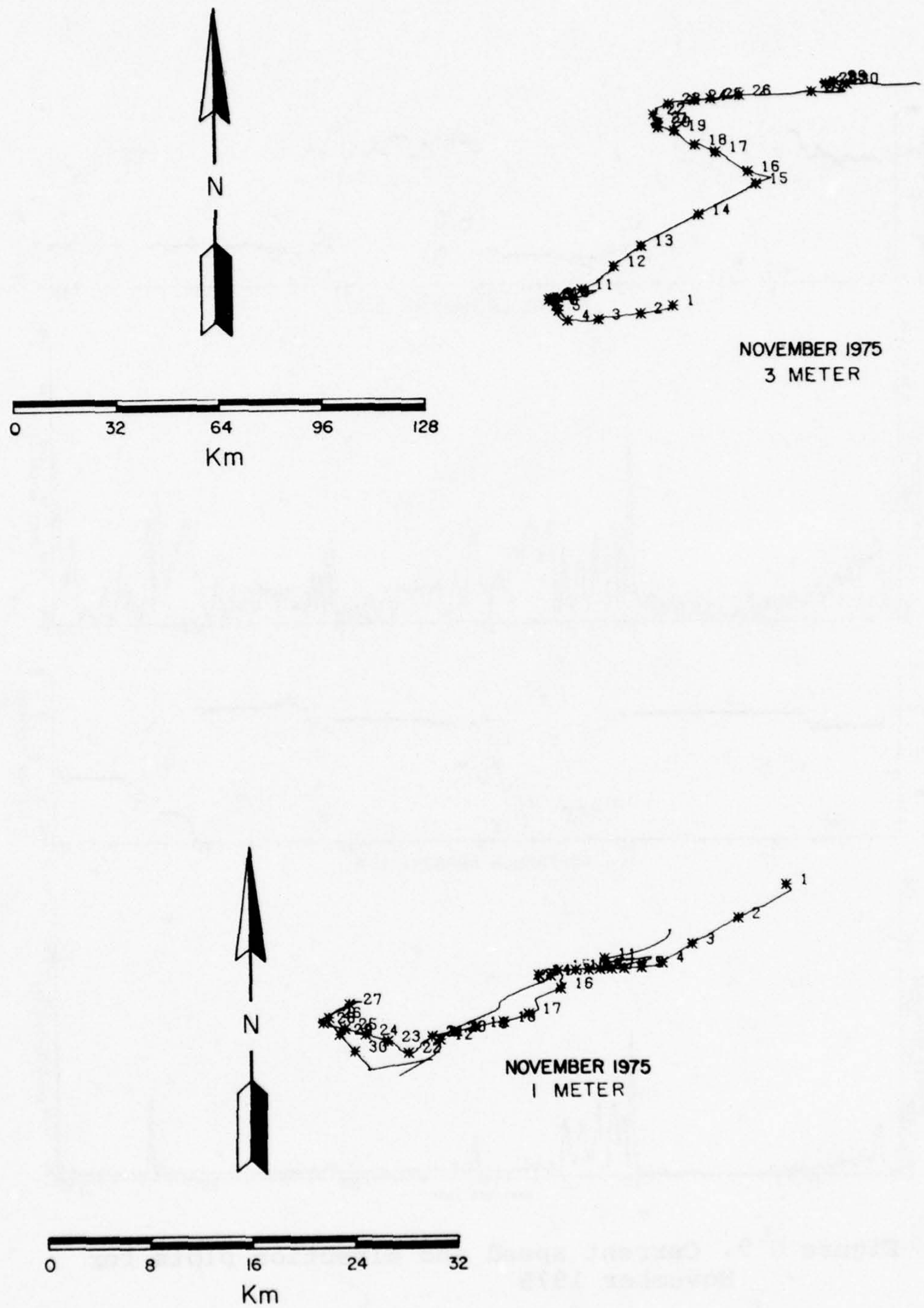


Figure C'10. Progressive vector plots of the currents for November 1975

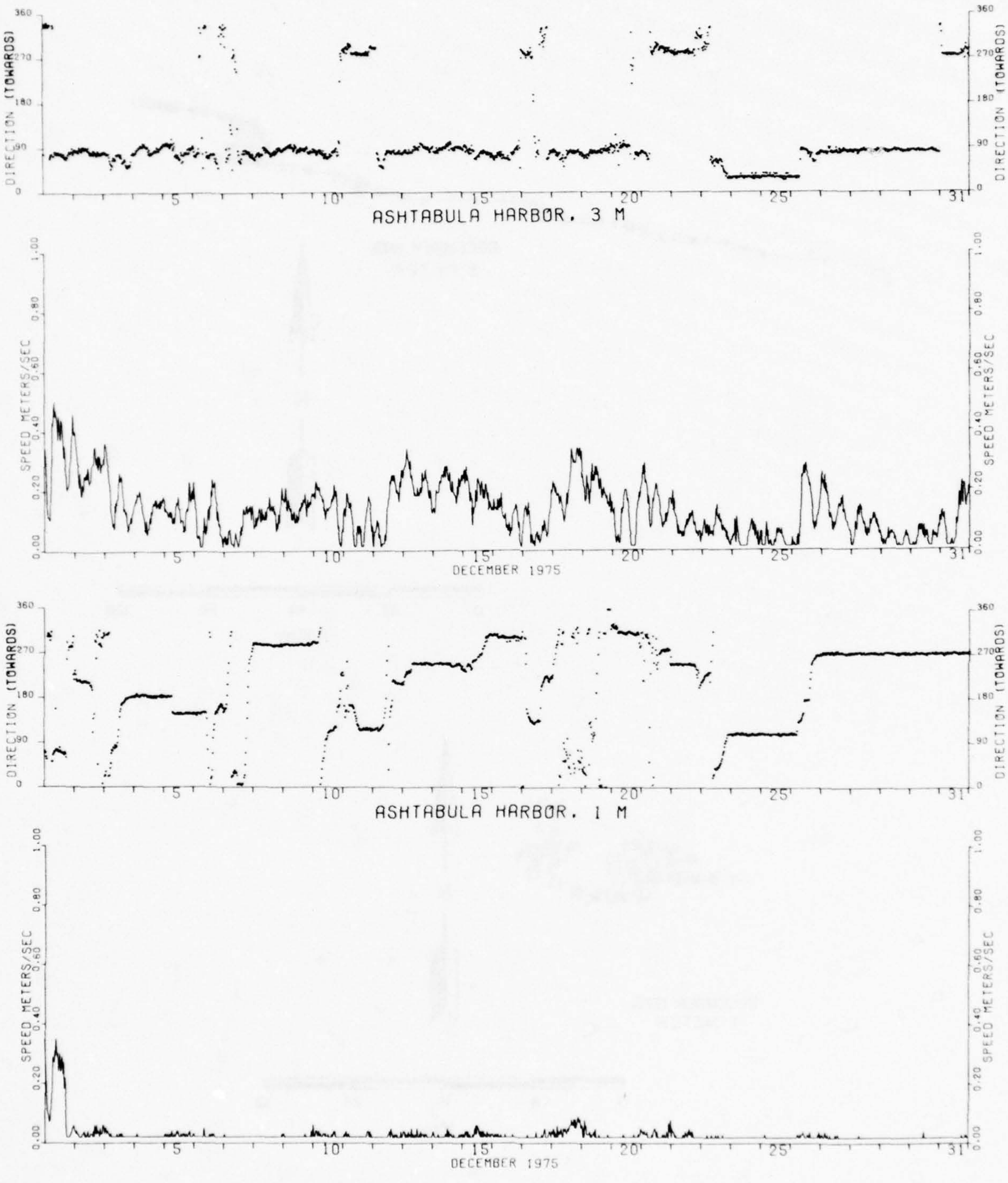
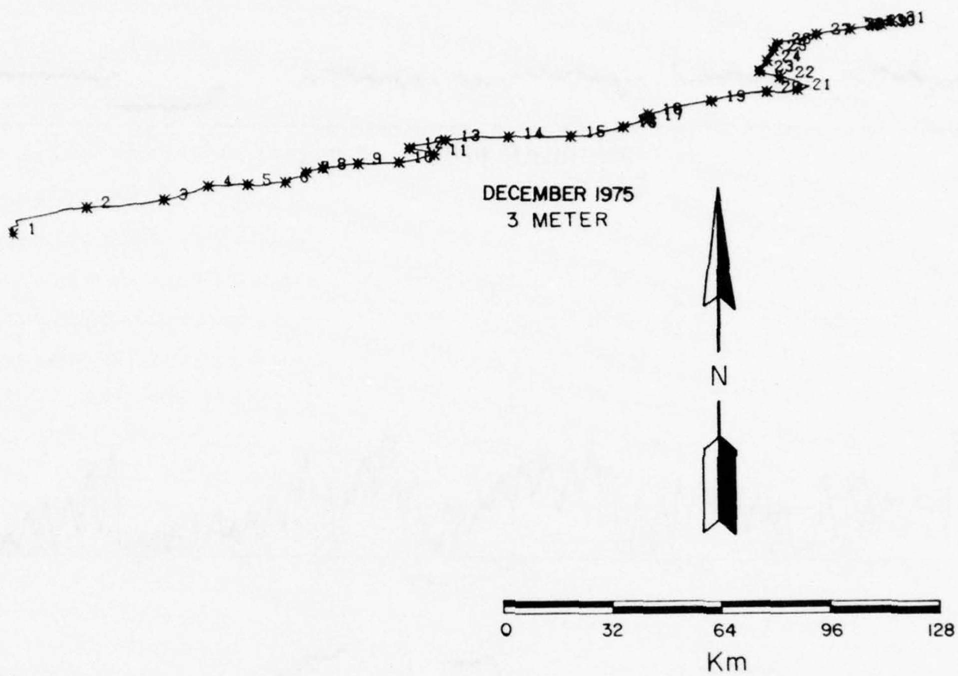


Figure C'11. Current speed and direction plots for December 1975



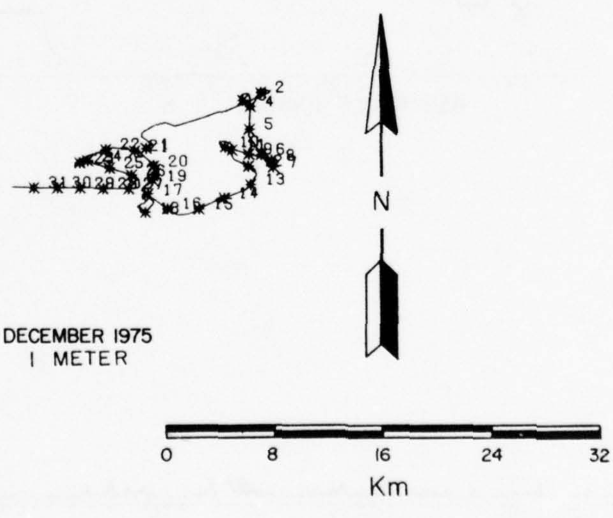


Figure C'12. Progressive vector plots of the currents for December 1975

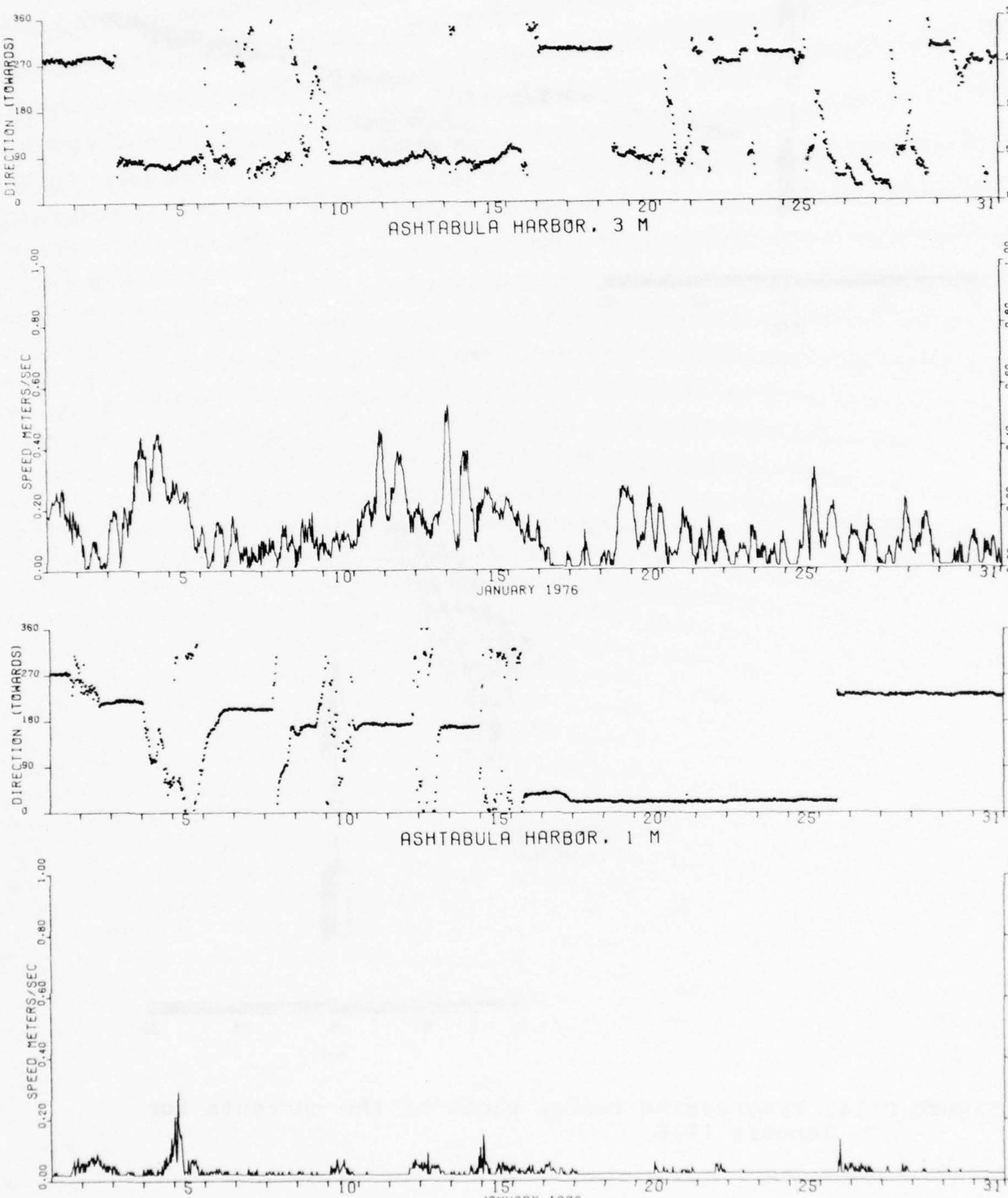
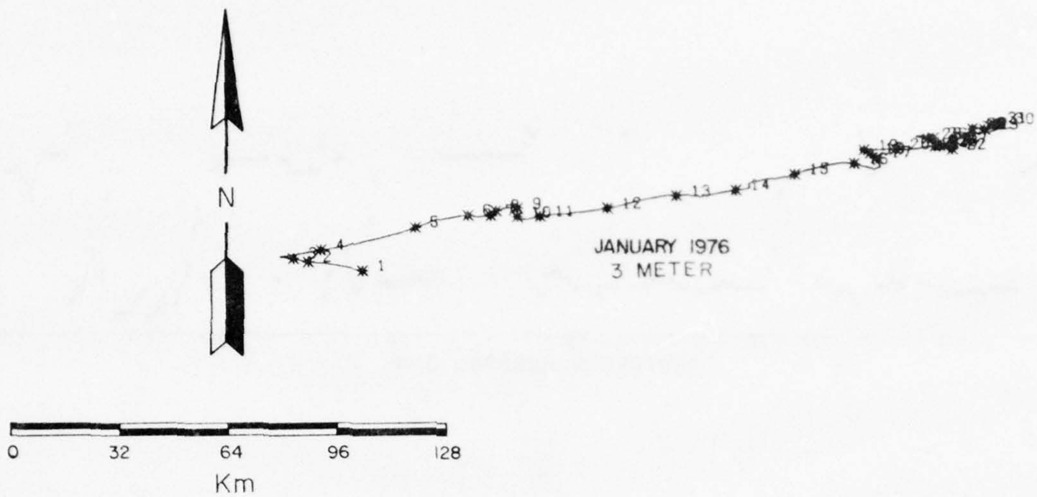


Figure C'13. Current speed and direction plots for January 1976



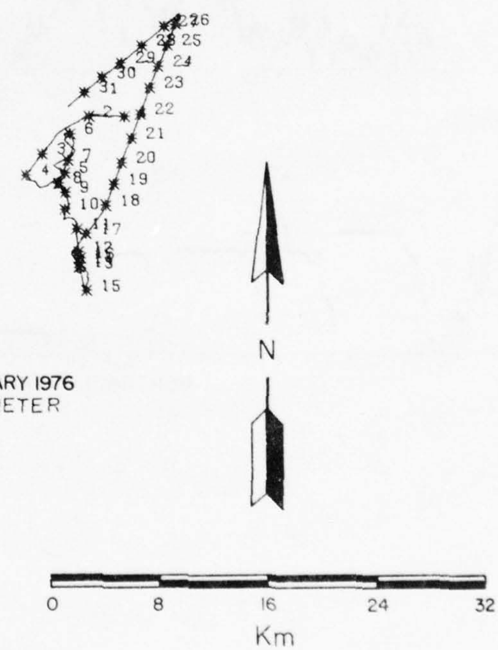


Figure C'14. Progressive vector plots of the currents for January 1976

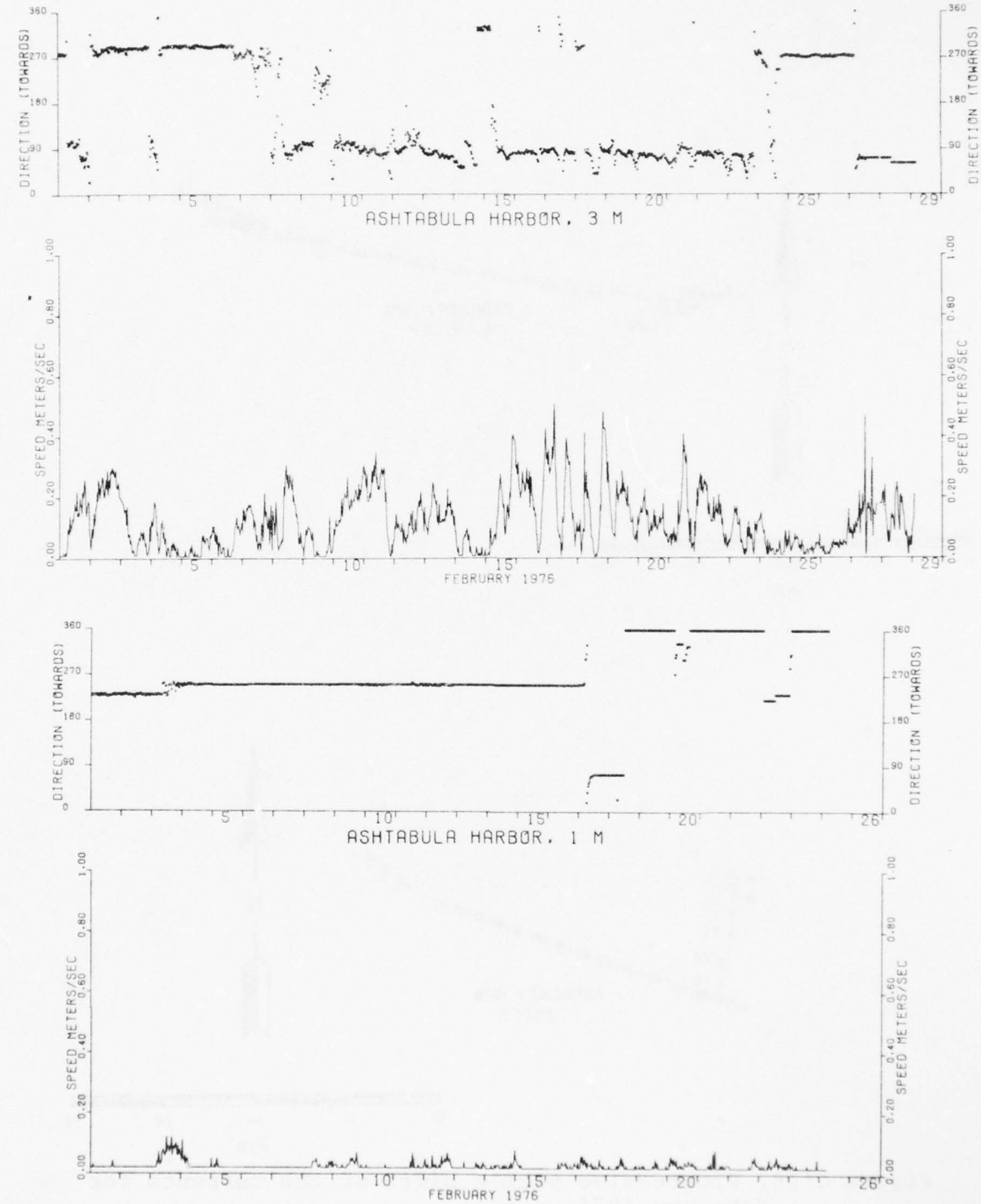


Figure C'15. Current speed and direction plots for February 1976

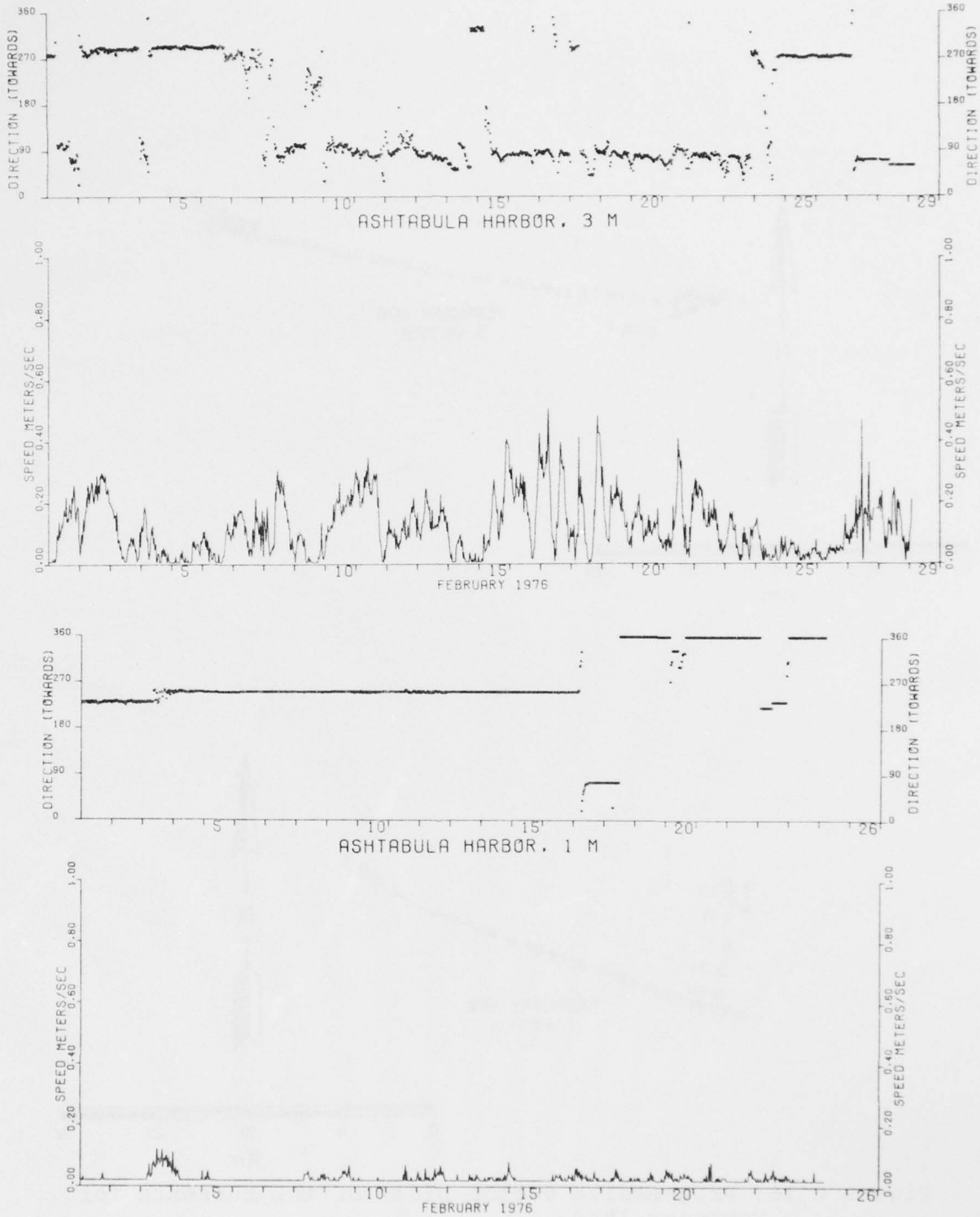


Figure C'15. Current speed and direction plots for February 1976

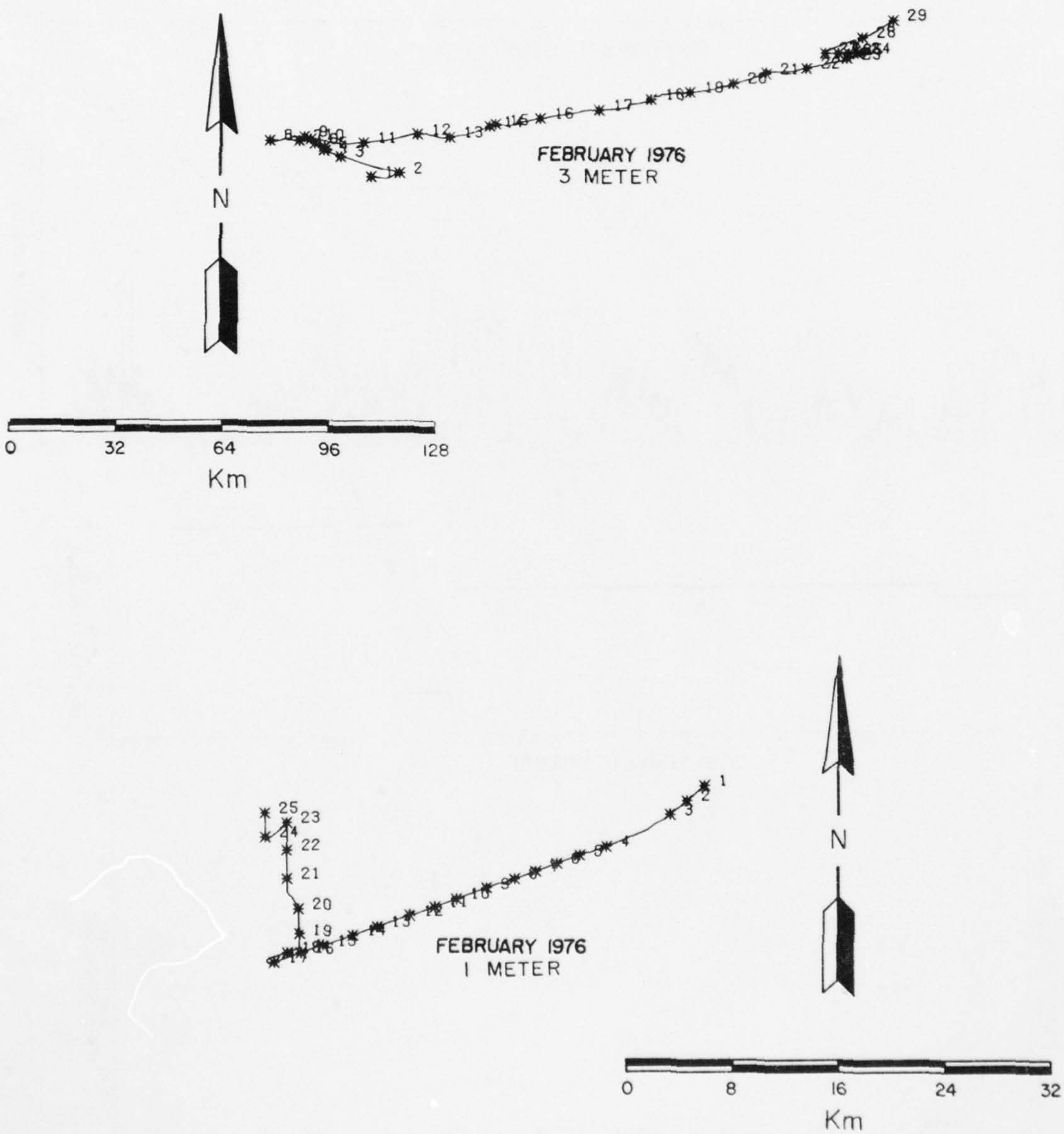


Figure C'16. Progressive vector plots of the currents for February 1976

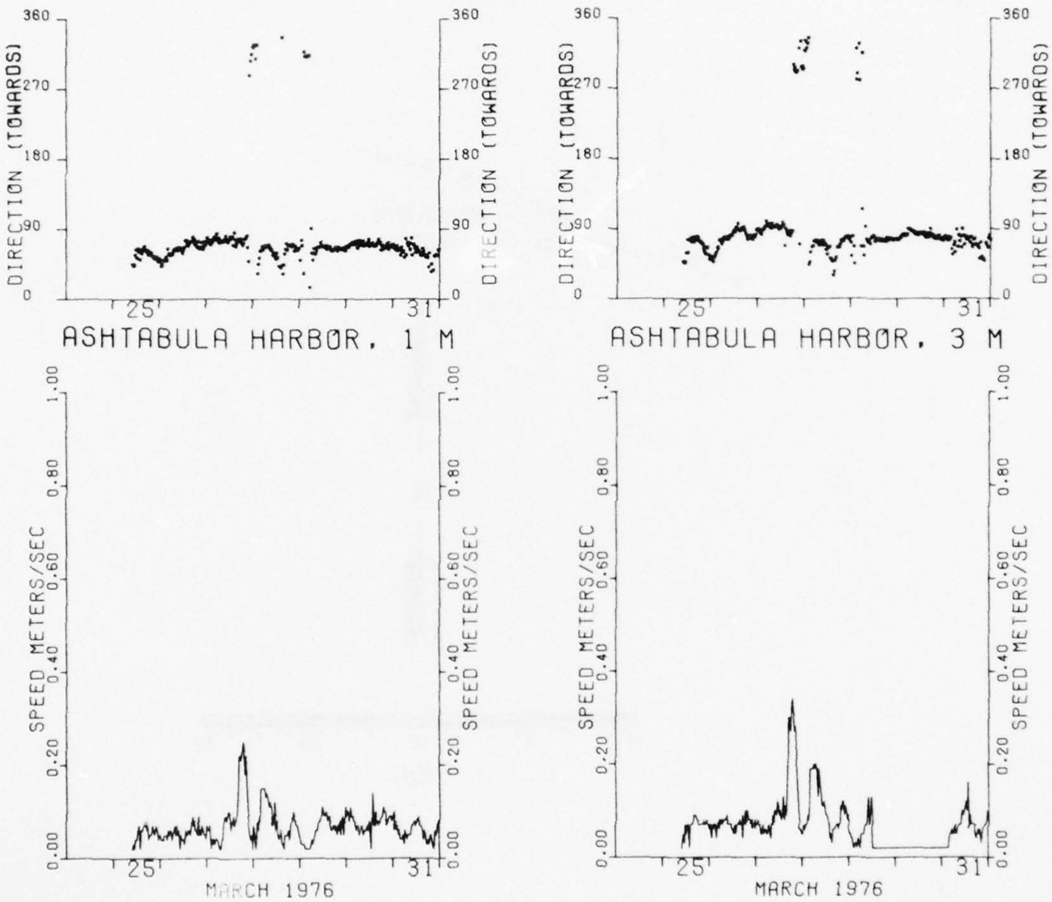


Figure C'17. Current speed and direction plots for March 1976

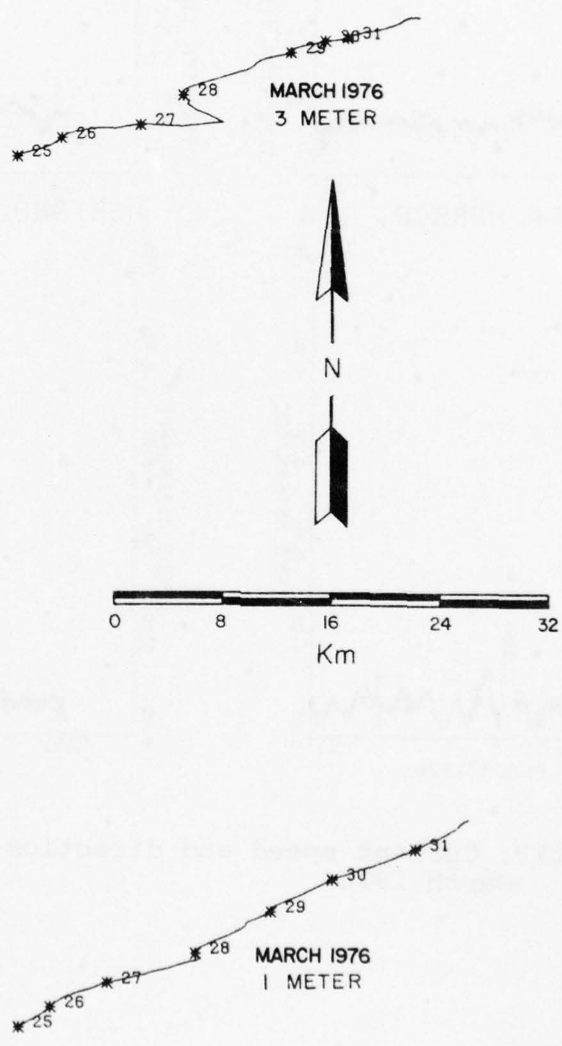


Figure C'18. Progressive vector plots of the currents for March 1976

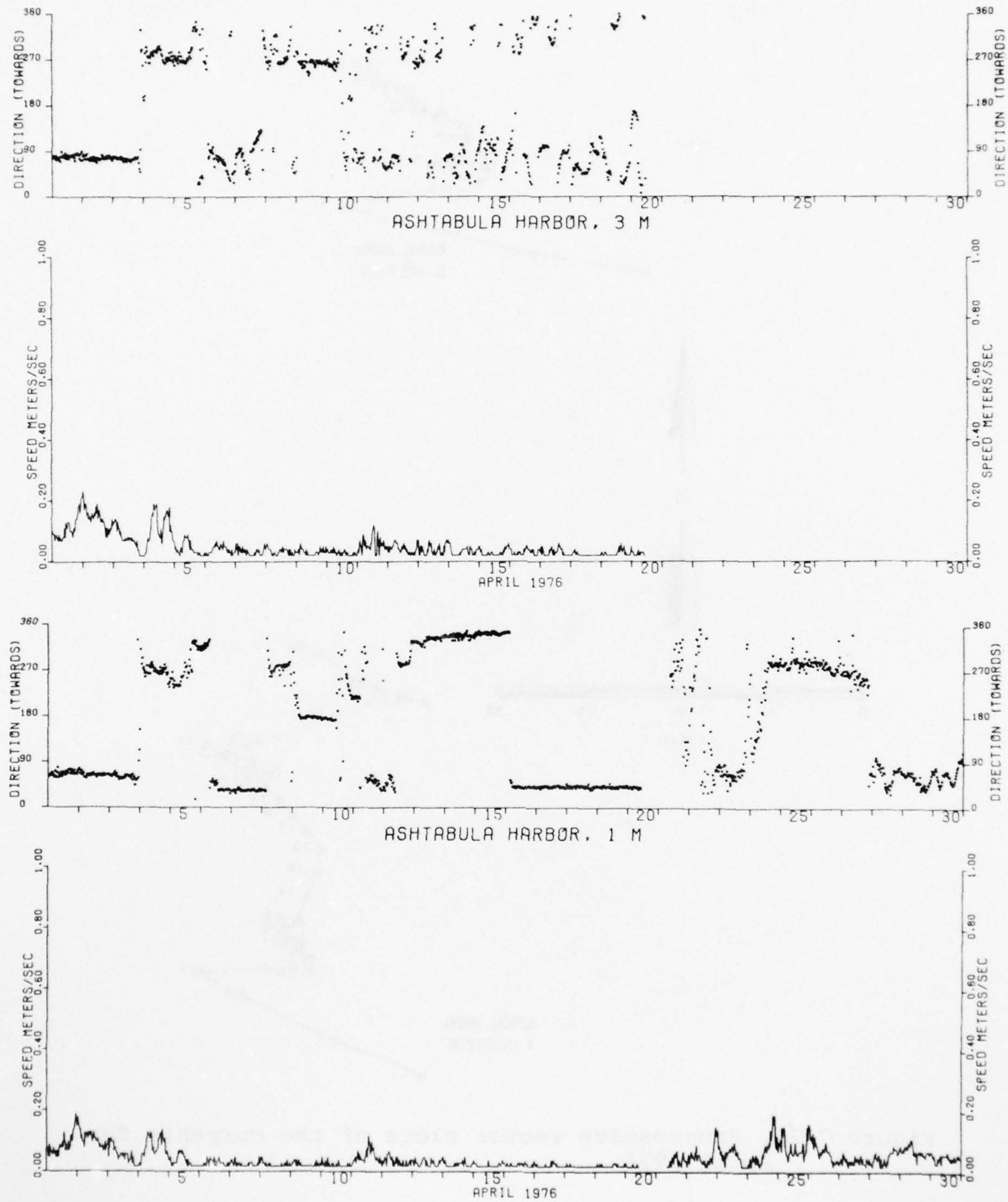


Figure C'19. Current speed and direction plots for April 1976

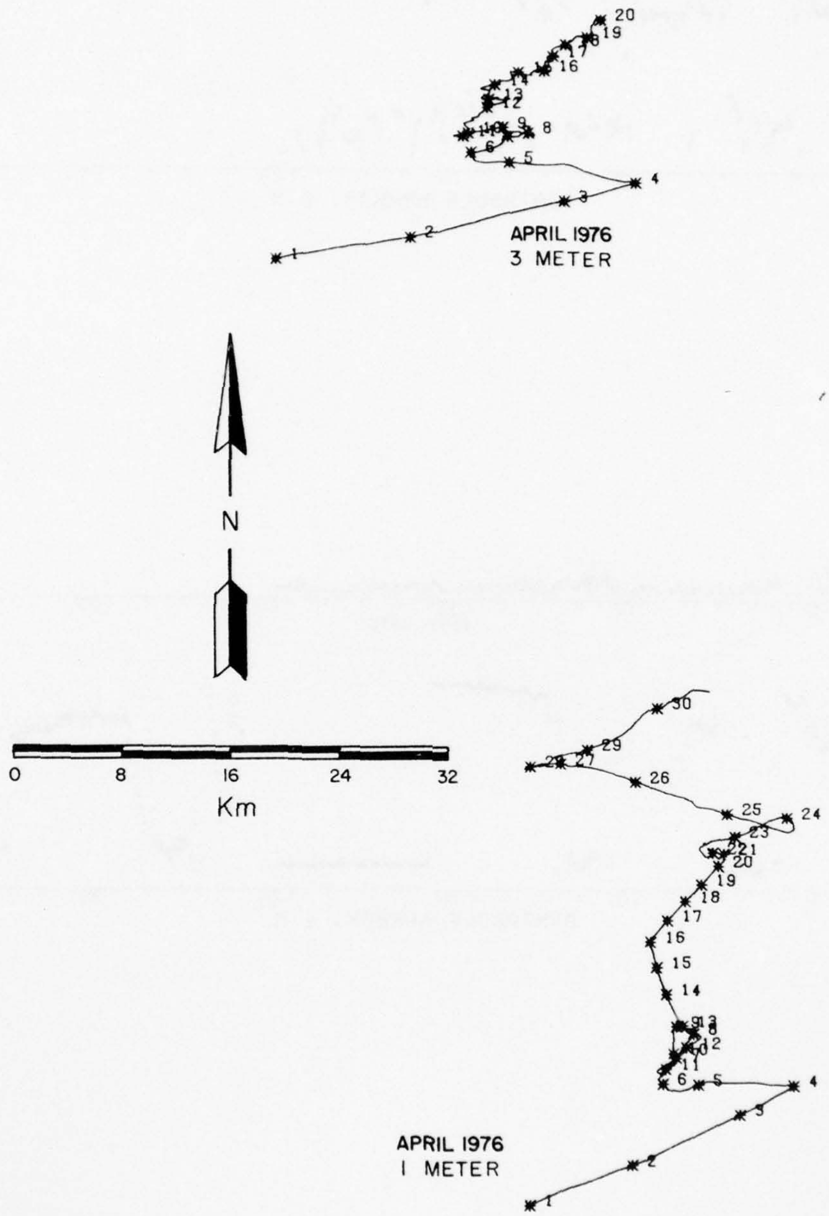


Figure C'20. Progressive vector plots of the currents for April 1976

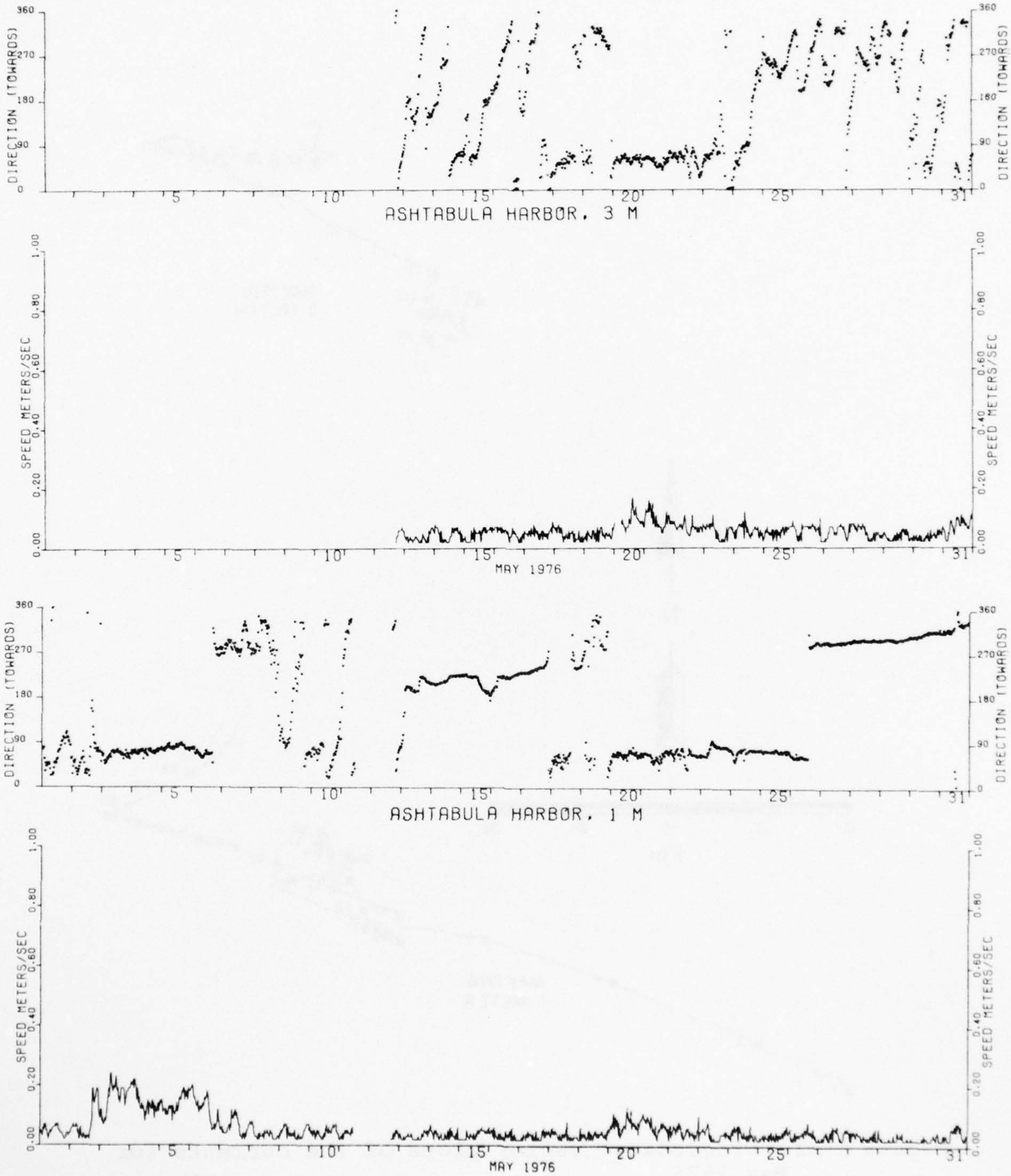


Figure C'21. Current speed and direction plots for May 1976

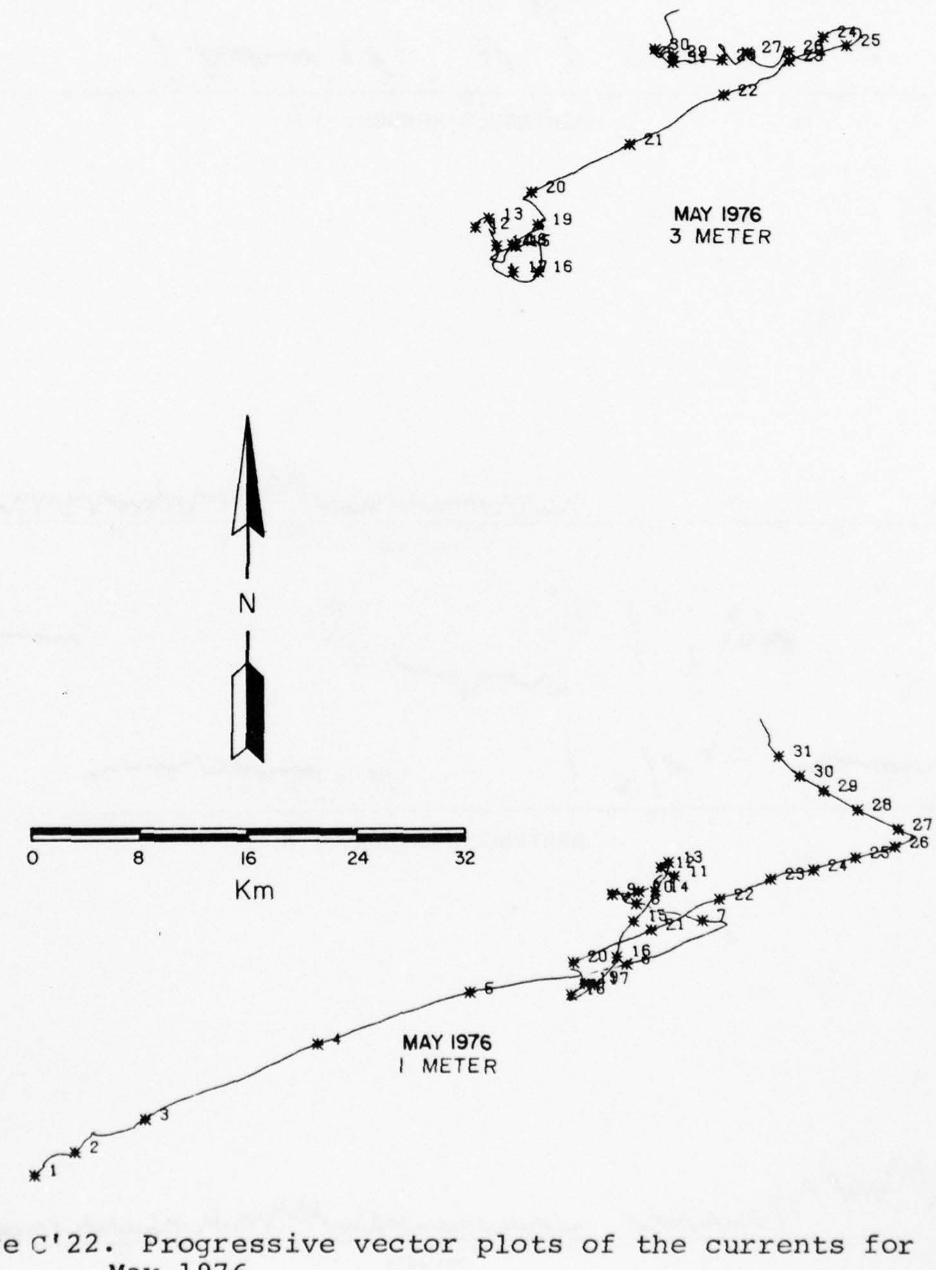


Figure C'22. Progressive vector plots of the currents for May 1976

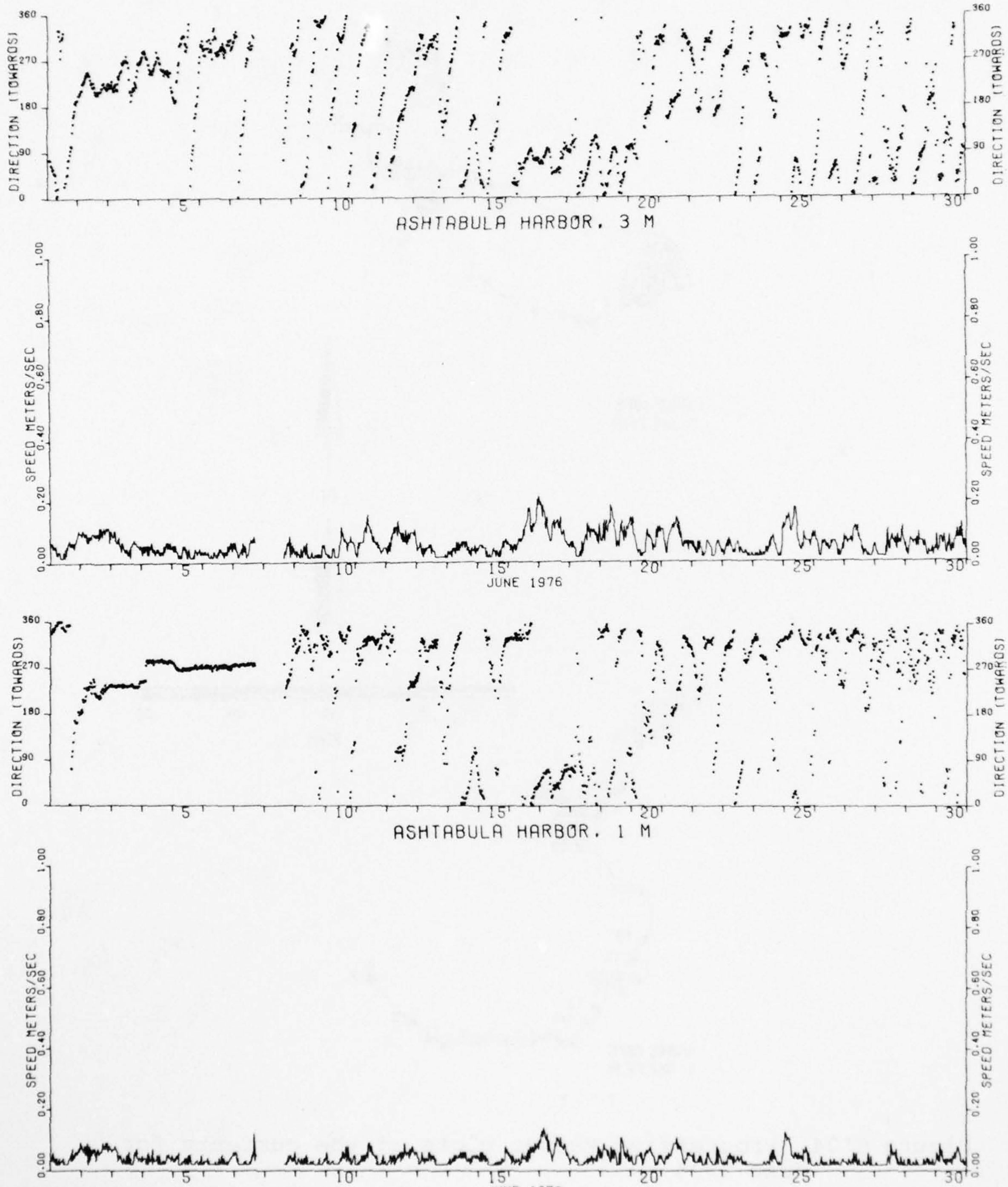


Figure C'23. Current speed and direction plots for June 1976

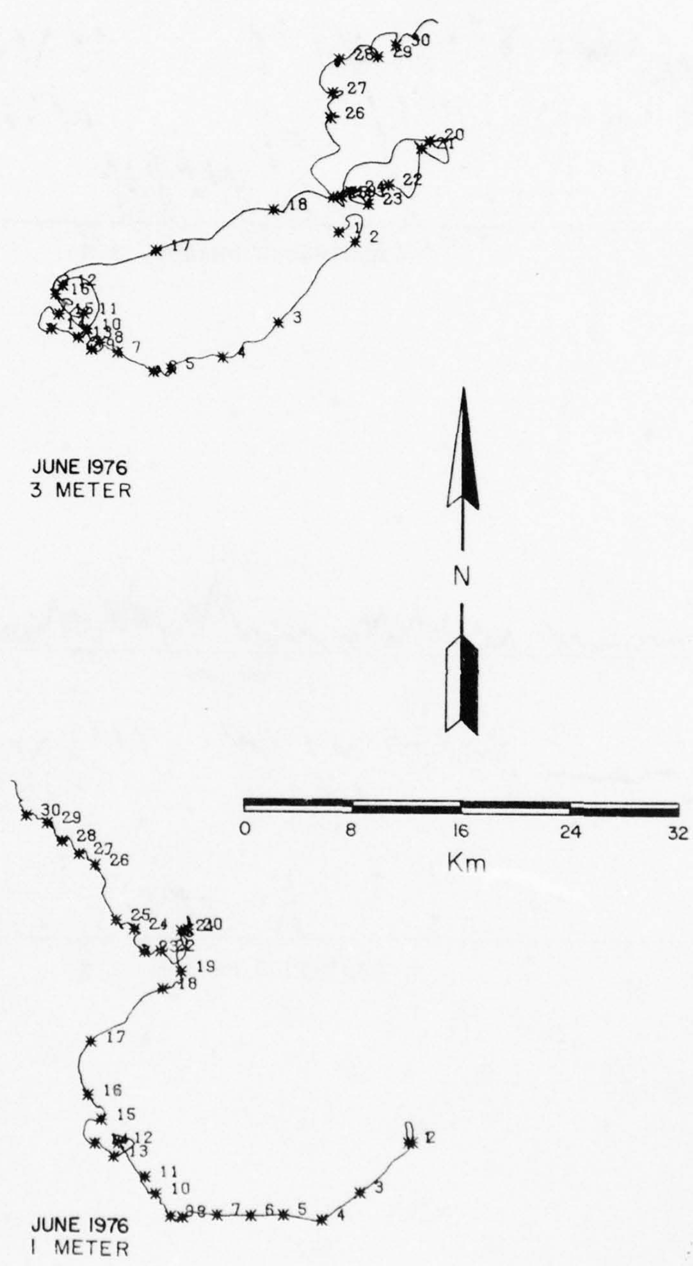


Figure C'24. Progressive vector plots of the currents for June 1976

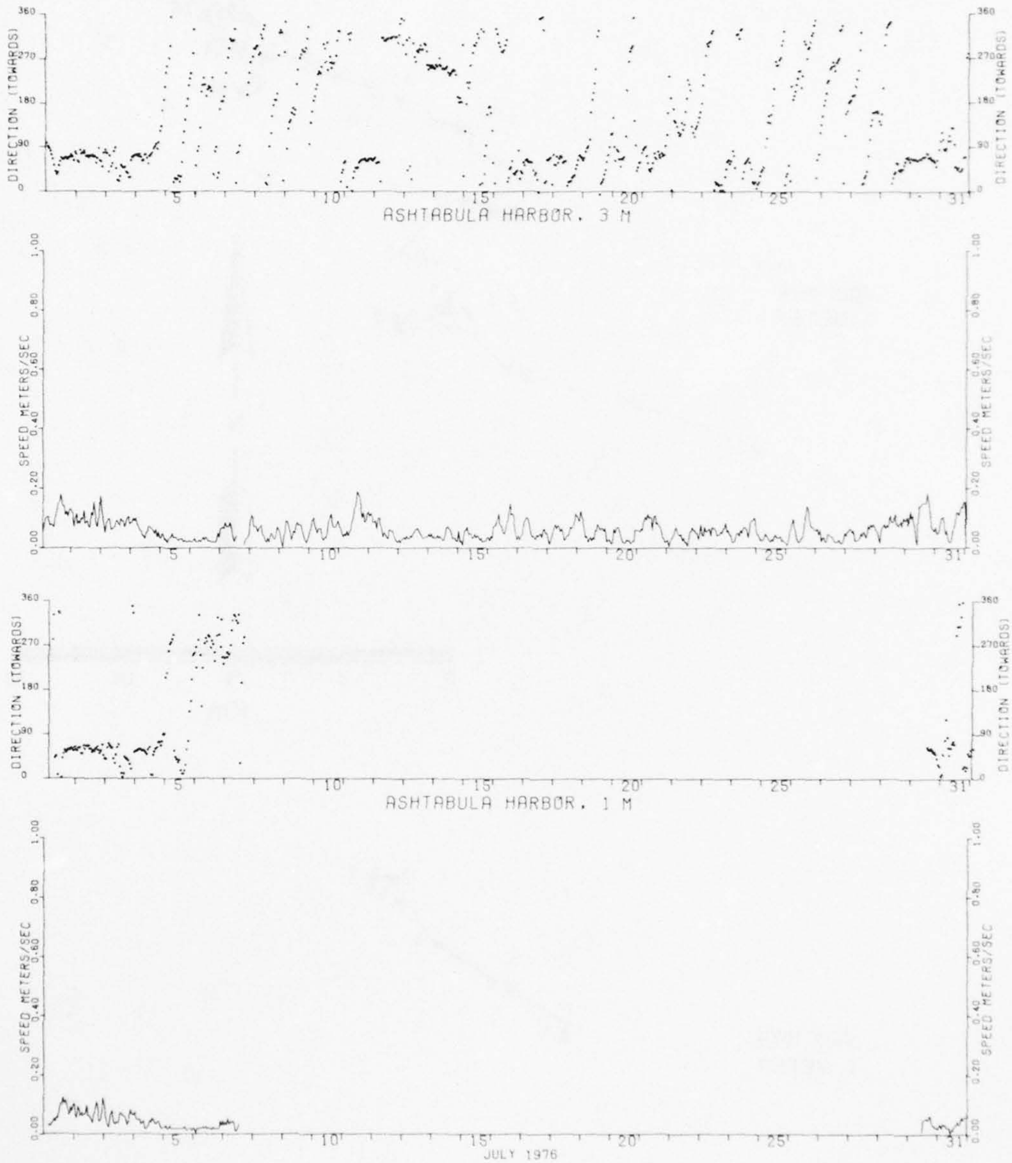


Figure C'25. Current speed and direction plots for July 1976

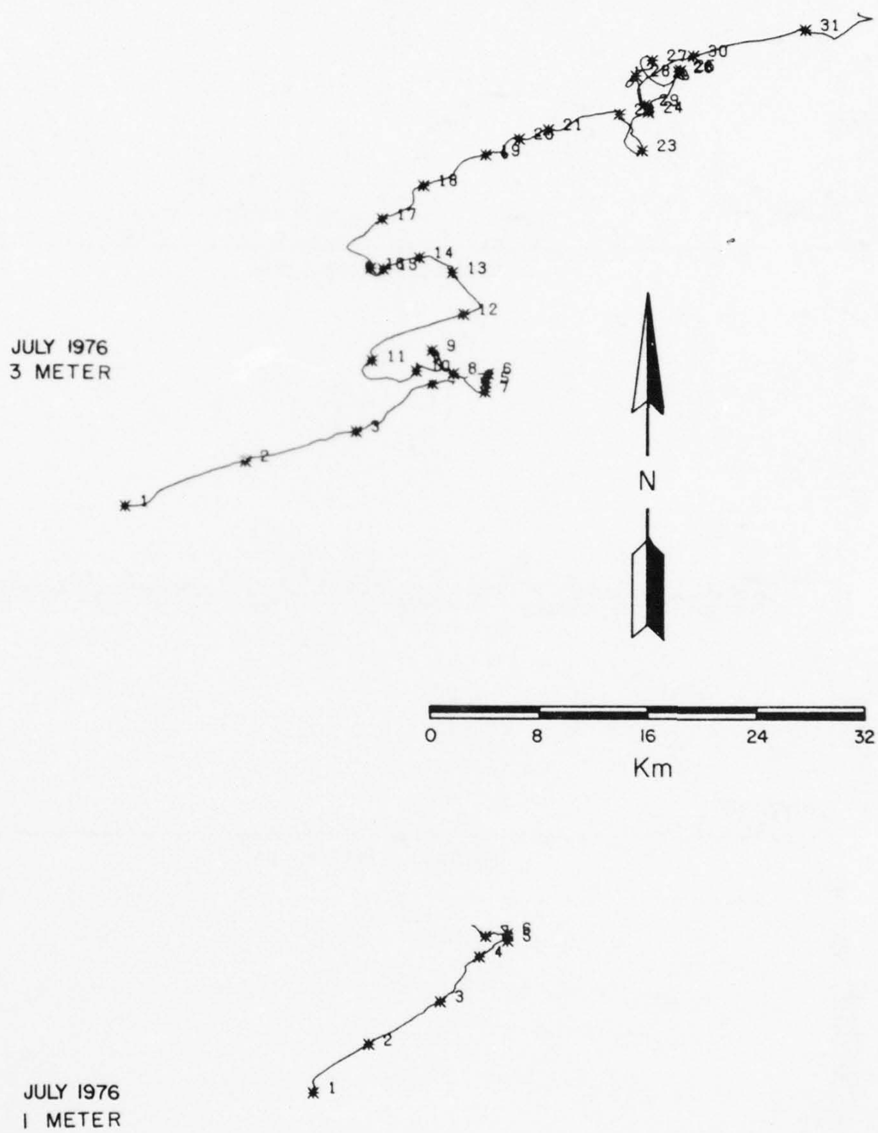


Figure C'26. Progressive vector plots of the currents for July 1976

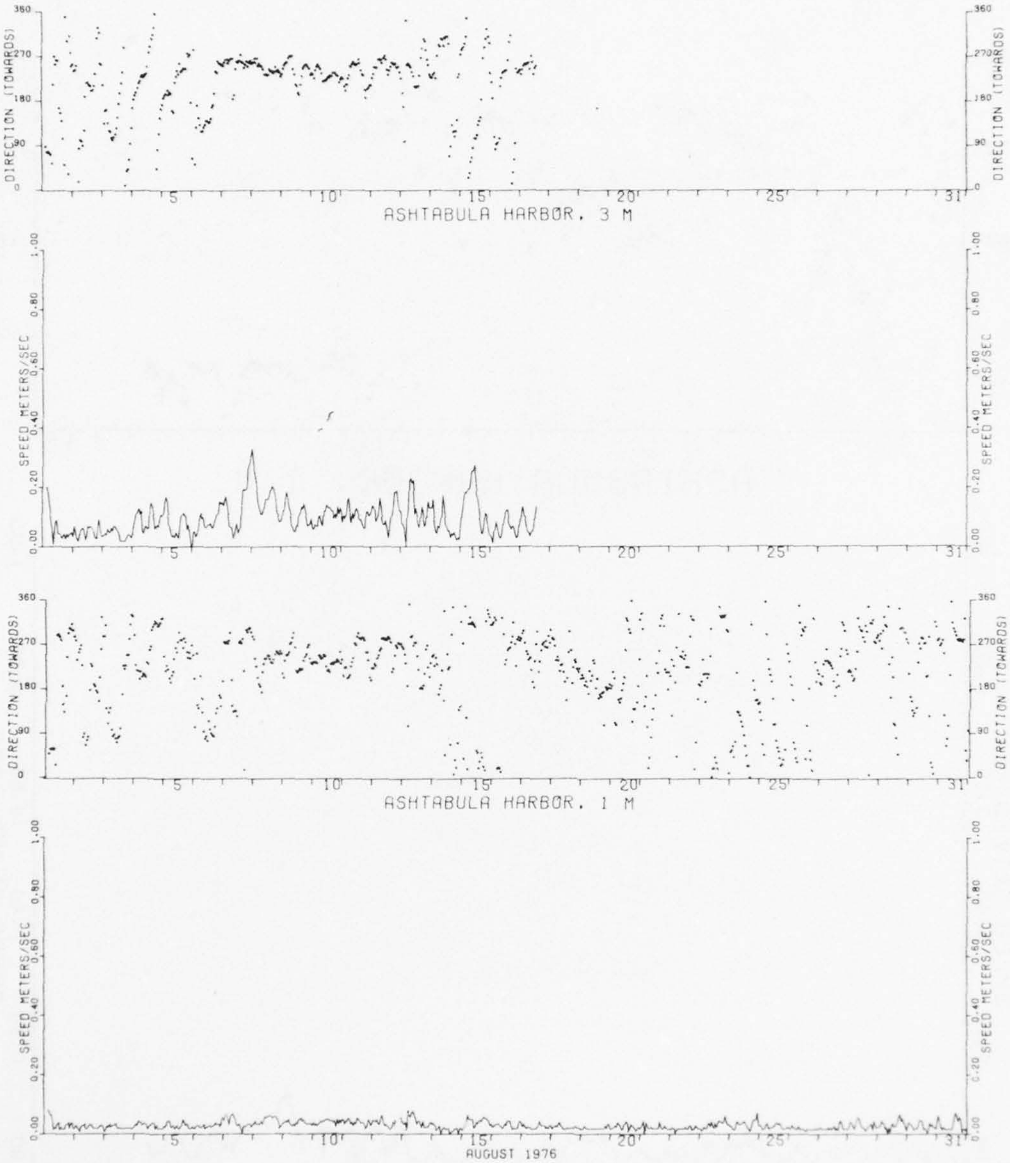


Figure C'27. Current speed and direction plots for August 1976

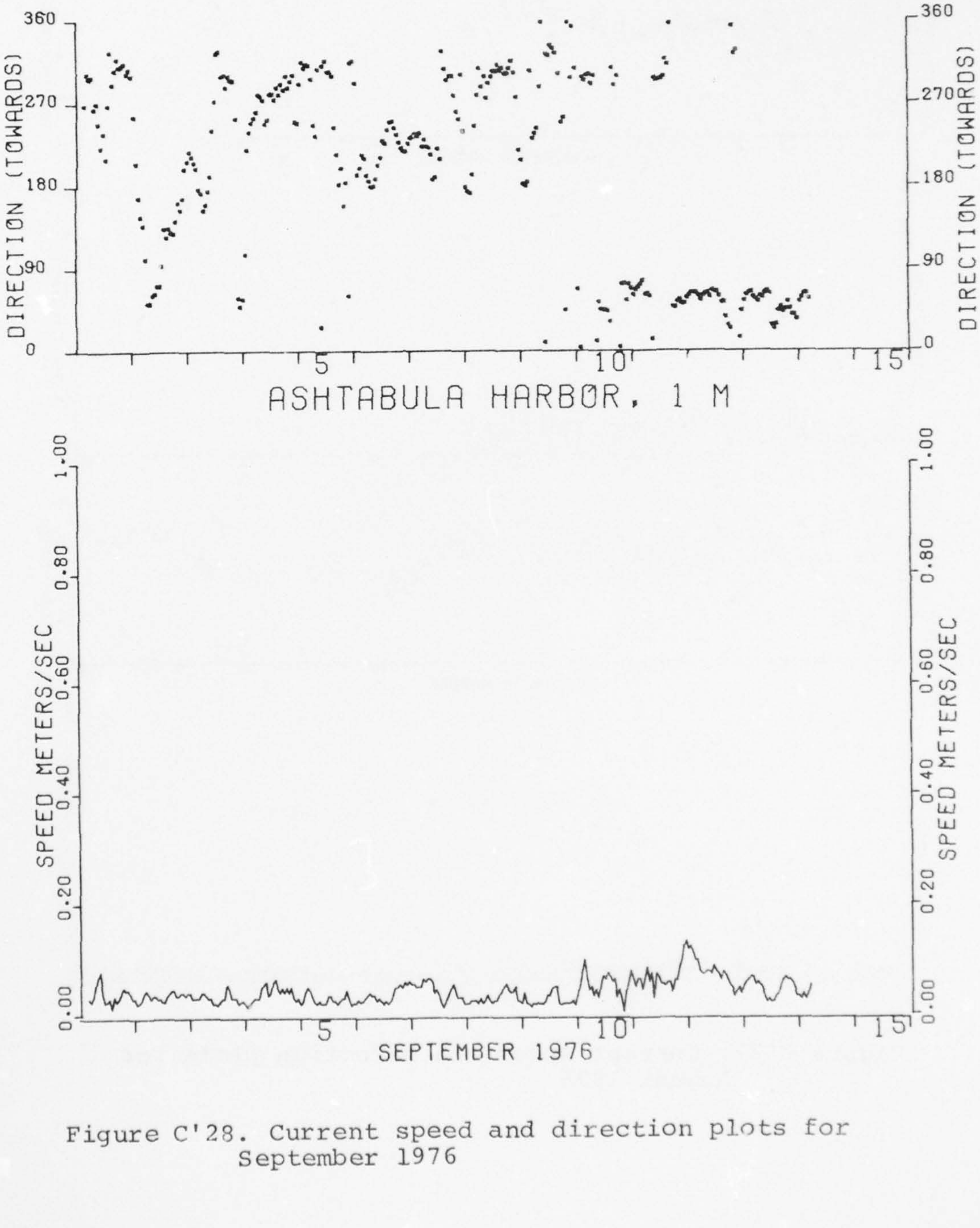


Figure C'28. Current speed and direction plots for September 1976

AD-A051 217 NALCO ENVIRONMENTAL SCIENCES NORTHBROOK IL F/G 13/2
AQUATIC DISPOSAL FIELD INVESTIGATIONS ASHTABULA RIVER DISPOSAL --ETC(U)
DEC 77 L J DANEK, G R ALTHER, P P PAILY DACW39-75-C-0108
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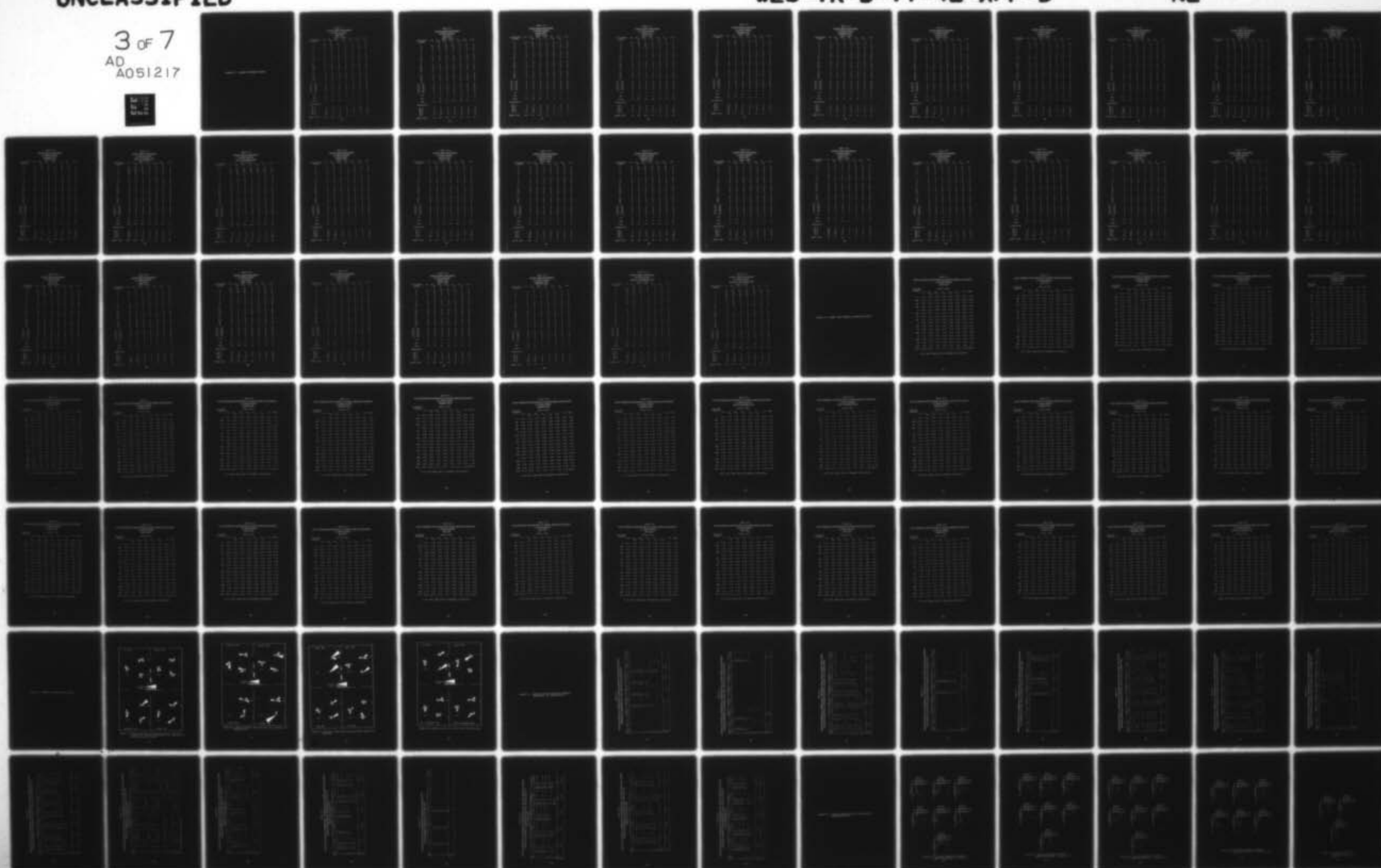

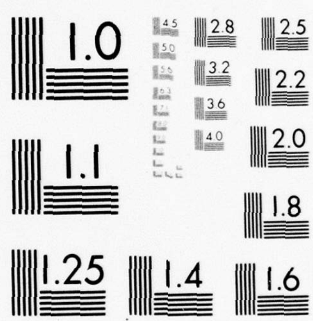

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

APPENDIX D': CURRENT PERSISTENCE TABLES

Table D'1

Current Speed Persistence

1 M Above Bottom

July 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	14	23	14	2	1	0	0
2	10	14	4	1	0	0	0
3	7	9	2	0	0	0	0
4	1	4	1	0	0	0	0
5	3	10	0	0	0	0	0
6	2	5	1	0	0	0	0
7	3	0	0	0	0	0	0
8	1	1	0	0	0	0	0
9	1	2	0	0	0	0	0
10	1	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	1	0	0	0	0	0	0
14	1	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	2	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	1	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	1	0	0	0	0	0	0
MAX	59	9	6	2	1	0	0
TOTAL	49	68	22	3	1	0	0
PERCENTILES							
50 %	3	2	1	1	1	0	0
80 %	7	5	2	2	1	0	0
90 %	14	6	3	2	1	0	0
95 %	17	6	4	2	1	0	0
99 %	59	9	6	2	1	0	0
SAMPLE SIZE	278	200	38	4	1	0	0

Table D'2

Current Speed Persistence

3 M Above Bottom

July 1975

PERSISTENCE (HOURS)	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
	SPEED, M/SEC						
1	10	13	23	29	17	9	1
2	3	11	19	16	7	3	3
3	3	12	12	8	4	1	1
4	0	6	7	2	1	0	0
5	2	2	0	2	0	1	1
6	1	2	1	1	2	0	0
7	0	0	0	0	0	0	0
8	0	0	0	1	1	0	0
9	0	0	0	0	0	0	0
10	0	2	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	6	10	6	8	8	5	5
TOTAL	19	48	62	59	32	14	6
PERCENTILES							
50 %	1	2	2	2	1	1	2
80 %	3	4	3	3	3	2	3
90 %	5	5	4	4	4	3	5
95 %	6	6	4	5	6	5	5
99 %	6	10	6	8	8	5	5
SAMPLE SIZE	41	137	131	117	67	23	15

Table D'3

Current Speed Persistence

1 M Above Bottom

August 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	12	11	9	4	3	0	0
2	4	10	5	1	0	2	0
3	6	9	3	0	0	0	0
4	5	5	2	1	0	0	0
5	4	3	0	0	0	0	0
6	0	4	0	0	0	0	0
7	1	2	0	0	0	1	1
8	0	3	0	0	0	0	0
9	3	0	0	0	0	0	0
10	0	1	0	0	0	0	0
11	1	0	0	0	0	0	0
12	0	0	1	0	0	0	0
13	0	2	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	11	13	12	4	1	7	7
TOTAL	36	50	20	6	3	3	1
PERCENTILES							
50 %	3	3	2	1	1	2	7
80 %	5	6	3	2	1	7	7
90 %	9	8	4	4	1	7	7
95 %	9	10	4	4	1	7	7
99 %	11	13	12	4	1	7	7
SAMPLE SIZE	123	191	48	10	3	11	7

Table D'4

Current Speed Persistence

3 M Above Bottom

August 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	28	54	41	27	19	11	2
2	11	31	24	13	7	4	5
3	4	6	11	4	3	1	1
4	3	7	10	3	0	1	0
5	0	5	6	3	0	0	0
6	0	1	2	0	0	0	0
7	0	2	2	0	0	0	1
8	0	1	1	0	0	0	0
9	0	0	1	0	0	0	0
10	0	1	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	1
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	4	10	9	5	3	4	24
TOTAL	46	108	98	50	29	17	10
PERCENTILES							
50 %	1	1	2	1	1	1	2
80 %	2	3	4	2	2	2	3
90 %	3	4	5	4	3	3	7
95 %	4	5	6	5	3	4	24
99 %	4	8	9	5	3	4	24
SAMPLE SIZE	74	225	235	92	42	26	46

Table D'5

Current Speed Persistence

1 M Above Bottom

September 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	11	21	22	17	13	4	2
2	4	15	6	5	2	2	0
3	7	10	5	1	1	1	0
4	3	7	2	1	0	0	0
5	2	1	0	0	1	0	1
6	1	3	0	0	0	0	0
7	1	1	3	0	0	0	0
8	2	1	1	0	0	0	0
9	1	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	1	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	1	0	0	0	0
16	1	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	1	0	0	0	0	0	0
20	1	0	0	0	0	0	0
21 - 25	2	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	2	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	1	0	0	0	0	0	0
MAX	55	8	15	4	5	3	5
TOTAL	41	59	40	24	17	7	3
PERCENTILES							
50 %	3	2	1	1	1	1	1
80 %	11	4	3	2	2	2	5
90 %	22	5	7	2	3	3	5
95 %	36	6	7	3	5	3	5
99 %	55	8	15	4	5	3	5
SAMPLE SIZE	339	147	101	34	25	11	7

Table D'6

Current Speed Persistence

3 M Above Bottom

September 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	5	12	8	11	10	5	1
2	6	6	8	4	4	3	1
3	4	5	4	2	0	1	0
4	0	1	1	1	2	0	0
5	0	0	2	1	0	0	0
6	0	0	1	0	0	0	0
7	0	1	1	0	0	0	0
8	0	3	0	0	0	0	0
9	0	0	0	1	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	3	8	7	9	4	3	2
TOTAL	15	28	25	20	16	9	2
PERCENTILES							
50 %	2	2	2	1	1	1	1
80 %	3	3	3	3	2	2	2
90 %	3	8	5	4	4	3	2
95 %	3	8	6	5	4	3	2
99 %	3	8	7	9	4	3	2
SAMPLE SIZE	29	74	63	43	26	14	3

Table D'7

Current Speed Persistence

1 M Above Bottom

October 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	7	25	8	5	2	2	0
2	1	10	6	2	2	1	0
3	3	5	1	0	1	1	0
4	2	5	1	0	0	0	0
5	3	1	0	0	0	0	0
6	1	0	0	0	0	0	0
7	1	1	0	0	0	0	1
8	5	1	0	0	0	0	0
9	2	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	1	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	2	0	0	0	0	0	0
14	1	0	0	0	0	0	0
15	1	1	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	2	0	0	0	0	0	0
26 - 30	2	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	2	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	1	0	0	0	0	0	0
> 50	2	0	0	0	0	0	0
MAX	68	15	4	2	3	3	7
TOTAL	39	49	16	7	5	4	1
PERCENTILES							
50 %	8	1	1	1	2	1	7
80 %	23	3	2	2	2	3	7
90 %	39	4	3	2	3	3	7
95 %	57	7	4	2	3	3	7
99 %	68	15	4	2	3	3	7
SAMPLE SIZE	525	115	27	9	9	7	7

Table D'8

Current Speed Persistence

3 M Above Bottom

October 1975

PERSISTENCE (HOURS)	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
			SPEED, M/SEC				
1	14	17	12	8	9	4	0
2	2	11	7	3	3	4	0
3	5	11	3	3	0	1	1
4	5	2	2	0	0	0	3
5	2	2	3	0	0	0	0
6	0	0	0	0	0	0	0
7	1	2	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	1	0	0	0	0
10	1	0	0	1	0	1	1
11	0	1	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	1	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	10	13	9	10	2	10	10
TOTAL	30	47	28	15	12	10	5
PERCENTILES							
50 %	2	2	2	1	1	2	4
80 %	4	3	4	3	2	2	4
90 %	5	5	5	3	2	3	10
95 %	7	7	5	10	2	10	10
99 %	10	13	9	10	2	10	10
SAMPLE SIZE	80	128	67	33	15	25	25

Table D'9

Current Speed Persistence

1 M Above Bottom

November 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	10	21	8	9	4	5	3
2	6	13	3	1	2	1	1
3	5	5	1	1	1	0	1
4	1	3	0	0	1	0	1
5	3	3	0	0	0	0	0
6	2	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	2	1	0	0	0	0	0
9	0	0	0	0	0	0	0
10	1	0	0	0	0	0	0
11	1	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	1	0	0	0	0	0	0
14	1	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	2	1	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	1	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	4	0	0	0	0	0	0
MAX	123	16	3	3	4	2	4
TOTAL	40	47	12	11	8	6	6
PERCENTILES							
50 %	3	2	1	1	1	1	1
80 %	13	3	2	1	3	1	3
90 %	40	5	2	2	4	2	4
95 %	61	5	3	3	4	2	4
99 %	123	16	3	3	4	2	4
SAMPLE SIZE	538	113	17	14	15	7	12

9

Table D'10

Current Speed Persistence

3 M Above Bottom

November 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	15	34	43	28	29	17	2
2	10	16	15	15	7	6	3
3	6	10	9	7	1	1	1
4	3	5	6	2	2	0	3
5	2	6	1	0	0	1	0
6	1	3	0	0	0	0	3
7	0	1	1	0	0	0	2
8	1	2	1	0	0	0	1
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	1
13	0	0	0	0	0	0	0
14	1	0	0	0	0	0	1
15	0	1	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	14	15	8	4	4	5	14
TOTAL	39	78	76	52	39	25	17
PERCENTILES							
50 %	2	2	1	1	1	1	4
80 %	4	4	3	2	2	2	7
90 %	5	5	4	3	2	2	12
95 %	8	7	4	3	4	3	14
99 %	14	15	8	4	4	5	14
SAMPLE SIZE	103	202	144	87	54	37	89

Table D'11

Current Speed Persistence

1 M Above Bottom

December 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	7	22	1	1	1	2	1
2	4	7	2	0	0	1	3
3	0	1	0	0	0	0	0
4	2	2	0	0	0	0	0
5	2	4	0	0	0	0	0
6	2	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	2	0	0	0	0	0	0
10	2	1	0	0	0	0	0
11	0	0	0	0	0	0	0
12	1	0	0	0	0	0	0
13	2	0	0	0	0	0	0
14	1	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	1	0	0	0	0	0	0
18	1	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	1	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	1	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	1	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	5	0	0	0	0	0	0
MAX	115	10	2	1	1	2	2
TOTAL	35	37	3	1	1	3	4
PERCENTILES							
50 %	9	1	2	1	1	1	2
80 %	20	3	2	1	1	2	2
90 %	55	5	2	1	1	2	2
95 %	89	5	2	1	1	2	2
99 %	115	10	2	1	1	2	2
SAMPLE SIZE	649	77	5	1	1	4	7

Table D'12

Current Speed Persistence

3 M Above Bottom

December 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	9	20	20	31	19	15	5
2	7	16	15	9	15	11	1
3	5	7	8	10	7	4	2
4	1	4	5	4	7	2	0
5	1	2	0	1	0	3	1
6	1	1	2	3	0	0	0
7	3	5	2	1	1	0	1
8	1	0	0	0	0	0	0
9	0	1	0	1	0	0	1
10	0	0	0	1	0	0	0
11	0	0	0	0	0	0	0
12	1	0	0	0	0	0	1
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	1
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	12	9	7	10	7	5	14
TOTAL	29	56	52	61	49	35	13
PERCENTILES							
50 %	2	2	2	1	2	2	3
80 %	6	4	3	3	3	3	9
90 %	7	7	4	5	4	4	12
95 %	8	7	6	6	4	5	14
99 %	12	9	7	10	7	5	14
SAMPLE SIZE	94	149	120	144	105	72	60

Table D'13

Current Speed Persistence

1 M Above Bottom

July to December 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	60	123	62	37	24	13	5
2	29	69	26	9	6	7	4
3	28	39	12	3	3	2	0
4	14	26	6	2	1	0	2
5	17	22	0	0	1	0	1
6	8	12	1	0	0	0	0
7	6	4	3	0	0	1	2
8	9	7	1	0	0	0	0
9	9	2	0	0	0	0	0
10	4	2	0	0	0	0	0
11	4	0	0	0	0	0	0
12	1	0	1	0	0	0	0
13	6	2	0	0	0	0	0
14	4	0	0	0	0	0	0
15	1	1	1	0	0	0	0
16	3	1	0	0	0	0	0
17	3	0	0	0	0	0	0
18	1	0	0	0	0	0	0
19	1	0	0	0	0	0	0
20	2	0	0	0	0	0	0
21 - 25	5	0	0	0	0	0	0
26 - 30	3	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	6	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	1	0	0	0	0	0	0
> 50	13	0	0	0	0	0	0
MAX	123	16	15	4	5	7	7
TOTAL	238	310	113	51	35	23	14
PERCENTILES							
50 %	4	2	1	1	1	1	2
80 %	13	4	3	2	2	2	5
90 %	24	5	4	2	3	3	7
95 %	54	7	7	3	4	3	7
99 %	96	13	12	4	5	7	7
SAMPLE SIZE	2452	843	236	72	54	40	40

Table D'14

Current Speed Persistence

3 M Above Bottom

July to December 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	81	150	146	134	103	60	11
2	39	90	88	60	43	30	13
3	27	51	46	34	15	10	6
4	12	24	32	12	12	3	6
5	7	17	12	7	0	5	2
6	3	8	6	4	2	0	3
7	4	11	6	1	1	0	4
8	2	6	2	1	1	0	1
9	0	1	2	2	0	0	1
10	1	3	0	2	0	1	1
11	0	1	0	0	0	0	0
12	1	0	0	0	0	0	2
13	0	1	0	0	0	0	0
14	1	0	0	0	0	0	2
15	0	1	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	1
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	14	15	9	10	8	10	24
TOTAL	178	364	340	257	177	109	53
PERCENTILES							
50 %	2	2	2	1	1	1	3
80 %	3	4	3	3	2	2	7
90 %	5	5	4	4	3	3	10
95 %	7	7	5	5	4	5	14
99 %	12	10	8	9	7	5	24
SAMPLE SIZE	421	915	760	516	309	197	238

Table D'15

Current Speed Persistence

1 M Above Bottom

January 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	11	19	3	0	1	1	0
2	5	9	0	1	0	0	0
3	3	3	1	0	0	0	0
4	0	4	0	0	0	0	0
5	4	1	0	0	0	0	0
6	1	3	0	0	0	0	0
7	1	1	0	0	0	0	0
8	0	0	0	0	0	0	0
9	2	0	0	0	0	0	0
10	1	2	0	0	0	0	0
11	1	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	1	0	0	0	0	0	0
15	1	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	1	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	1	0	0	0	0	0
21 - 25	2	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	1	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	1	0	0	0	0	0	0
> 50	4	0	0	0	0	0	0
MAX	91	20	3	2	1	1	0
TOTAL	40	43	4	1	1	1	0
PERCENTILES							
50 %	5	2	1	2	1	1	0
80 %	18	4	3	2	1	1	0
90 %	49	6	3	2	1	1	0
95 %	76	10	3	2	1	1	0
99 %	91	20	3	2	1	1	0
SAMPLE SIZE	602	132	6	2	1	1	0

Table D'16

Current Speed Persistence

3 M Above Bottom

January 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	9	29	27	32	17	15	6
2	9	19	17	11	10	4	2
3	4	9	7	6	3	1	0
4	4	5	4	3	5	1	1
5	2	4	3	2	2	2	0
6	2	2	3	0	0	0	1
7	0	1	0	0	0	2	2
8	0	2	0	0	0	0	0
9	2	0	0	0	0	0	1
10	1	0	0	0	1	0	0
11	0	0	0	0	0	0	1
12	1	0	0	0	0	0	1
13	1	0	0	0	0	0	0
14	0	0	1	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	13	8	14	5	10	7	12
TOTAL	35	71	62	54	38	25	15
PERCENTILES							
50 %	2	2	2	1	2	1	2
80 %	5	3	3	3	4	3	7
90 %	9	5	5	3	4	5	11
95 %	12	6	6	4	5	7	12
99 %	13	8	14	5	10	7	12
SAMPLE SIZE	130	169	145	94	86	54	66

Table D'17

Current Speed Persistence

1 M Above Bottom

February 1976

PERSISTENCE (HOURS)	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	6	16	1	0	0	0	0
2	0	7	0	0	0	0	0
3	2	2	1	0	0	0	0
4	2	5	0	0	0	0	0
5	0	1	1	0	0	0	0
6	2	2	0	0	0	0	0
7	4	2	0	0	0	0	0
8	1	0	0	0	0	0	0
9	3	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	2	0	0	0	0	0	0
16	1	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	1	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	1	0	0	0	0	0	0
21 - 25	2	0	0	0	0	0	0
26 - 30	2	0	0	0	0	0	0
31 - 35	1	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	1	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	2	0	0	0	0	0	0
MAX	75	7	5	0	0	0	0
TOTAL	33	35	3	0	0	0	0
PERCENTILES							
50 %	8	2	3	0	0	0	0
80 %	24	4	5	0	0	0	0
90 %	34	6	5	0	0	0	0
95 %	52	7	5	0	0	0	0
99 %	75	7	5	0	0	0	0
SAMPLE SIZE	485	87	9	0	0	0	0

SPEED, M/SEC

Table D'18

Current Speed Persistence

3 M Above Bottom

February 1976

PERSISTENCE (HOURS)	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
			SPEED, M/SEC				
1	13	30	31	35	27	16	6
2	6	13	14	14	11	10	2
3	3	5	8	6	5	2	1
4	2	7	6	3	1	1	3
5	0	2	2	1	2	1	2
6	2	1	0	0	0	0	2
7	4	2	0	0	0	1	0
8	0	2	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	1
11	1	0	0	0	0	0	0
12	1	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	1	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	15	8	5	5	5	7	10
TOTAL	33	62	61	59	46	31	17
PERCENTILES							
50 %	2	2	1	1	1	1	3
80 %	7	4	3	2	2	2	5
90 %	7	5	4	3	3	3	6
95 %	12	7	4	4	4	5	10
99 %	15	8	5	5	5	7	10
SAMPLE SIZE	120	145	117	98	78	58	57

Table D'19

Current Speed Persistence

1 M Above Bottom

March 1976

PERSISTENCE (HOURS)	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
	SPEED, M/SEC						
1	5	5	7	0	1	0	0
2	2	3	2	0	1	1	0
3	0	3	2	1	0	0	0
4	0	4	2	0	0	0	0
5	1	0	1	0	0	0	0
6	0	0	1	0	0	0	0
7	0	1	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	2	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	1	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	1	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	5	29	6	3	2	2	0
TOTAL	8	20	15	1	2	1	0
PERCENTILES							
50 %	1	3	2	3	1	2	0
80 %	2	7	4	3	2	2	0
90 %	5	9	5	3	2	2	0
95 %	5	11	6	3	2	2	0
99 %	5	29	6	3	2	2	0
SAMPLE SIZE	14	101	36	3	3	2	0

Table D'20

Current Speed Persistence

3 M Above Bottom

March 1976

PERSISTENCE (HOURS)	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
	SPEED, M/SEC						
1	1	1	4	3	1	2	0
2	0	0	1	0	0	0	0
3	0	2	4	0	1	0	1
4	1	1	1	0	0	0	0
5	0	2	0	0	0	0	0
6	0	1	1	0	0	0	0
7	0	1	0	0	0	0	0
8	0	1	1	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	1	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	1	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	1	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	40	13	8	1	3	1	3
TOTAL	3	11	12	3	2	2	1
PERCENTILES							
50 %	4	5	3	1	1	1	3
80 %	40	8	4	1	3	1	3
90 %	40	11	6	1	3	1	3
95 %	40	13	8	1	3	1	3
99 %	40	13	8	1	3	1	3
SAMPLE SIZE	45	66	36	3	4	2	3

Table D'21

Current Speed Persistence

1 M Above Bottom

April 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	12	21	12	5	3	0	0
2	12	9	4	6	0	0	0
3	2	8	4	1	0	0	0
4	5	6	2	0	0	0	0
5	0	9	1	0	0	0	0
6	2	1	1	0	0	0	0
7	1	2	2	0	0	0	0
8	0	2	0	0	0	0	0
9	2	3	1	0	0	0	0
10	0	1	1	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	1	0	0	0	0	0	0
14	0	1	0	0	0	0	0
15	0	0	0	0	0	0	0
16	1	0	0	0	0	0	0
17	2	0	0	0	0	0	0
18	1	1	0	0	0	0	0
19	1	1	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	3	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	1	0	0	0	0	0	0
MAX	71	19	10	3	1	0	0
TOTAL	46	65	28	12	3	0	0
PERCENTILES							
50 %	2	3	2	2	1	0	0
80 %	13	5	5	2	1	0	0
90 %	19	9	7	2	1	0	0
95 %	21	10	9	3	1	0	0
99 %	71	19	10	3	1	0	0
SAMPLE SIZE	336	256	84	20	3	0	0

Table D'22

Current Speed Persistence

3 M Above Bottom

April 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	9	10	7	2	1	1	0
2	4	6	2	4	2	0	0
3	7	5	2	0	1	0	0
4	2	8	4	1	1	0	0
5	1	4	0	1	0	0	0
6	4	8	1	0	0	0	0
7	0	2	0	1	0	0	0
8	2	1	0	0	0	0	0
9	1	1	0	0	0	0	0
10	2	0	0	0	0	0	0
11	1	0	0	0	0	0	0
12	1	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	1	1	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	1	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	1	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	33	14	6	7	4	1	0
TOTAL	37	46	16	9	5	1	0
PERCENTILES							
50 %	3	4	2	2	2	1	0
80 %	9	6	4	5	3	1	0
90 %	12	7	4	7	4	1	0
95 %	17	8	6	7	4	1	0
99 %	33	14	6	7	4	1	0
SAMPLE SIZE	207	182	39	26	12	1	0

Table D'23

Current Speed Persistence

1 M Above Bottom

May 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03- .08	.08- .12	.12- .17	.17- .21	.21- .26	>.26
1	25	37	7	5	2	2	0
2	13	9	3	4	3	0	0
3	9	3	1	0	2	0	0
4	5	4	3	3	0	0	0
5	4	1	1	1	0	0	0
6	3	3	1	1	0	0	0
7	4	5	1	0	0	0	0
8	3	3	0	0	0	0	0
9	0	3	0	0	1	0	0
10	1	5	0	0	1	0	0
11	0	2	0	0	0	0	0
12	1	1	0	0	0	0	0
13	0	2	0	0	0	0	0
14	1	1	0	0	0	0	0
15	0	1	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	1	1	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	24	21	7	6	10	1	0
TOTAL	70	81	17	14	9	2	0
PERCENTILES							
50 %	2	2	2	2	2	1	0
80 %	5	8	4	4	9	1	0
90 %	7	10	6	5	10	1	0
95 %	10	13	7	6	10	1	0
99 %	24	21	7	6	10	1	0
SAMPLE SIZE	248	349	46	36	33	2	0

Table D'24

Current Speed Persistence

3 M Above Bottom

May 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	13	9	9	1	0	0	0
2	4	6	2	1	0	0	0
3	3	2	2	0	0	0	0
4	3	4	1	1	0	0	0
5	3	0	1	0	0	0	0
6	1	2	0	0	0	0	0
7	0	2	0	0	0	0	0
8	1	2	2	0	0	0	0
9	0	2	1	0	0	0	0
10	0	2	0	0	0	0	0
11	0	4	0	0	0	0	0
12	0	1	0	0	0	0	0
13	0	1	0	0	0	0	0
14	1	0	0	0	0	0	0
15	0	1	0	0	0	0	0
16	0	1	0	0	0	0	0
17	0	1	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	2	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	1	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	14	33	9	4	0	0	0
TOTAL	29	43	18	3	0	0	0
PERCENTILES							
50 %	2	6	1	2	0	0	0
80 %	5	11	5	4	0	0	0
90 %	6	16	8	4	0	0	0
95 %	8	22	9	4	0	0	0
99 %	14	33	9	4	0	0	0
SAMPLE SIZE	85	318	53	7	0	0	0

Table D'25

Current Speed Persistence

1 M Above Bottom

June 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	28	36	10	2	0	0	0
2	10	8	1	0	0	0	0
3	7	6	0	0	0	0	0
4	6	10	2	0	0	0	0
5	8	6	2	0	0	0	0
6	1	5	1	0	0	0	0
7	0	2	0	0	0	0	0
8	3	5	0	0	0	0	0
9	0	1	0	0	0	0	0
10	3	3	0	0	0	0	0
11	0	2	0	0	0	0	0
12	0	1	0	0	0	0	0
13	4	1	0	0	0	0	0
14	0	0	0	0	0	0	0
15	1	1	0	0	0	0	0
16	1	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	1	0	0	0	0	0
19	1	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	1	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	22	18	6	1	0	0	0
TOTAL	74	88	16	2	0	0	0
PERCENTILES							
50 %	2	2	1	1	0	0	0
80 %	6	6	4	1	0	0	0
90 %	13	10	5	1	0	0	0
95 %	15	11	6	1	0	0	0
99 %	22	18	6	1	0	0	0
SAMPLE SIZE	317	343	36	2	0	0	0

Table D'26

Current Speed Persistence

3 M Above Bottom

June 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	17	23	20	8	3	1	0
2	11	11	11	6	1	0	0
3	4	11	6	1	1	0	0
4	4	8	1	2	0	0	0
5	3	7	3	0	0	0	0
6	1	3	2	0	0	0	0
7	1	3	1	0	0	0	0
8	1	1	2	0	0	0	0
9	0	3	0	0	0	0	0
10	0	1	1	0	0	0	0
11	1	1	0	0	0	0	0
12	0	1	0	0	0	0	0
13	0	1	0	0	0	0	0
14	0	3	0	0	0	0	0
15	1	1	0	0	0	0	0
16	0	1	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	1	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	1	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	15	45	22	4	3	1	0
TOTAL	44	80	48	17	5	1	0
PERCENTILES							
50 %	2	3	2	2	1	1	0
80 %	4	7	5	2	2	1	0
90 %	6	11	7	4	3	1	0
95 %	8	14	8	4	3	1	0
99 %	15	45	22	4	3	1	0
SAMPLE SIZE	129	383	146	31	8	1	0

Table D'27

Current Speed Persistence

1 M Above Bottom

July 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	5	8	4	2	0	0	0
2	2	2	1	0	0	0	0
3	1	2	2	0	0	0	0
4	1	0	2	0	0	0	0
5	0	1	0	0	0	0	0
6	1	2	0	0	0	0	0
7	1	0	0	0	0	0	0
8	0	2	0	0	0	0	0
9	0	1	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	2	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	1	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	1	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	48	14	4	1	0	0	0
TOTAL	12	21	9	2	0	0	0
PERCENTILES							
50 %	2	3	2	1	0	0	0
80 %	6	8	4	1	0	0	0
90 %	7	11	4	1	0	0	0
95 %	48	11	4	1	0	0	0
99 %	48	14	4	1	0	0	0
SAMPLE SIZE	77	96	20	2	0	0	0

Table D'28

Current Speed Persistence

3 M Above Bottom

July 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	21	28	16	8	3	0	0
2	11	14	13	3	0	0	0
3	8	14	10	2	1	0	0
4	5	9	6	0	0	0	0
5	1	7	3	1	0	0	0
6	3	12	0	0	0	0	0
7	2	4	3	1	0	0	0
8	0	3	0	0	0	0	0
9	2	2	0	0	0	0	0
10	0	2	1	0	0	0	0
11	1	1	0	0	0	0	0
12	0	1	1	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	1	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	1	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	21	19	12	7	3	0	0
TOTAL	55	98	53	15	4	0	0
PERCENTILES							
50 %	2	3	2	1	1	0	0
80 %	4	6	4	3	3	0	0
90 %	7	8	5	5	3	0	0
95 %	9	10	7	7	3	0	0
99 %	21	19	12	7	3	0	0
SAMPLE SIZE	174	373	154	32	6	0	0

Table D'29

Current Speed Persistence

1 M Above Bottom

August 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	26	25	3	0	0	0	0
2	10	14	0	0	0	0	0
3	7	16	0	0	0	0	0
4	4	5	0	0	0	0	0
5	6	4	0	0	0	0	0
6	7	2	0	0	0	0	0
7	1	3	0	0	0	0	0
8	2	1	0	0	0	0	0
9	4	3	0	0	0	0	0
10	2	2	0	0	0	0	0
11	1	1	0	0	0	0	0
12	0	0	0	0	0	0	0
13	1	2	0	0	0	0	0
14	1	1	0	0	0	0	0
15	2	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	1	1	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	3	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	38	22	1	0	0	0	0
TOTAL	78	80	3	0	0	0	0
PERCENTILES							
50 %	3	3	1	0	0	0	0
80 %	8	5	1	0	0	0	0
90 %	13	9	1	0	0	0	0
95 %	24	11	1	0	0	0	0
99 %	38	22	1	0	0	0	0
SAMPLE SIZE	439	302	3	0	0	0	0

Table D'30

Current Speed Persistence

3 M Above Bottom

August 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	12	8	23	18	6	1	1
2	3	12	12	7	0	1	0
3	1	8	4	3	1	1	0
4	0	3	4	1	1	1	0
5	0	5	5	3	2	0	1
6	1	2	1	0	1	0	0
7	0	2	0	0	0	0	0
8	0	2	0	0	0	0	0
9	0	1	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	1	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	6	16	6	5	6	4	5
TOTAL	17	44	49	32	11	4	2
PERCENTILES							
50 %	1	3	2	1	1	2	1
80 %	2	5	4	3	5	4	5
90 %	3	7	5	4	5	4	5
95 %	6	8	5	5	6	4	5
99 %	6	16	6	5	6	4	5
SAMPLE SIZE	27	160	106	60	29	10	6

Table D'31

Current Speed Persistence

1 M Above Bottom

September 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	6	6	4	1	0	0	0
2	1	7	1	0	0	0	0
3	3	3	1	0	0	0	0
4	5	3	0	0	0	0	0
5	2	3	1	0	0	0	0
6	3	2	0	0	0	0	0
7	1	0	0	0	0	0	0
8	3	3	0	0	0	0	0
9	1	0	0	0	0	0	0
10	0	2	0	0	0	0	0
11	0	1	0	0	0	0	0
12	0	1	0	0	0	0	0
13	2	0	0	0	0	0	0
14	0	1	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	1	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	13	21	5	1	0	0	0
TOTAL	27	33	7	1	0	0	0
PERCENTILES							
50 %	4	4	1	1	0	0	0
80 %	8	8	3	1	0	0	0
90 %	9	11	5	1	0	0	0
95 %	13	14	5	1	0	0	0
99 %	13	21	5	1	0	0	0
SAMPLE SIZE	131	170	14	1	0	0	0

Table D'32

Current Speed Persistence

1 M Above Bottom

January to September 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	124	170	49	15	7	3	0
2	54	69	13	11	4	1	0
3	34	45	12	2	2	0	0
4	27	40	11	3	0	0	0
5	24	27	7	1	0	0	0
6	20	19	4	1	0	0	0
7	12	16	3	0	0	0	0
8	12	16	0	0	0	0	0
9	14	13	1	0	1	0	0
10	7	15	1	0	1	0	0
11	2	8	0	0	0	0	0
12	1	3	0	0	0	0	0
13	8	5	0	0	0	0	0
14	3	6	0	0	0	0	0
15	6	2	0	0	0	0	0
16	3	0	0	0	0	0	0
17	2	0	0	0	0	0	0
18	3	2	0	0	0	0	0
19	2	0	0	0	0	0	0
20	1	1	0	0	0	0	0
21 - 25	10	4	0	0	0	0	0
26 - 30	2	1	0	0	0	0	0
31 - 35	1	0	0	0	0	0	0
36 - 40	4	0	0	0	0	0	0
41 - 45	1	0	0	0	0	0	0
46 - 50	2	0	0	0	0	0	0
> 50	6	0	0	0	0	0	0
MAX	128	29	10	6	10	2	0
TOTAL	385	462	101	33	15	4	0
PERCENTILES							
50 %	3	2	2	2	2	1	0
80 %	9	6	4	3	3	2	0
90 %	15	10	5	4	9	2	0
95 %	24	12	6	5	10	2	0
99 %	75	21	9	6	10	2	0
SAMPLE SIZE	2649	1836	254	66	40	5	0

Table D'33

Current Speed Persistence

3 M Above Bottom

January to September 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26
1	94	137	136	107	58	36	13
2	47	81	72	46	24	15	4
3	30	55	43	18	13	4	2
4	21	46	26	11	8	3	4
5	10	31	18	8	6	3	3
6	13	31	8	0	1	0	3
7	7	17	4	2	0	3	2
8	5	14	5	0	0	0	0
9	5	9	1	0	0	0	1
10	3	5	2	0	1	0	1
11	3	7	0	0	0	0	1
12	4	3	1	0	0	0	1
13	1	3	0	0	0	0	0
14	2	4	1	0	0	0	0
15	2	2	0	0	0	0	0
16	0	3	0	0	0	0	0
17	1	1	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	1	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	1	2	1	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	1	1	0	0	0	0	0
36 - 40	1	0	0	0	0	0	0
41 - 45	0	1	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	40	45	22	7	10	7	12
TOTAL	251	454	318	192	111	64	35
PERCENTILES							
50 %	2	3	2	1	1	1	3
80 %	5	6	4	3	3	3	6
90 %	8	8	5	4	4	4	9
95 %	12	11	6	5	5	5	11
99 %	21	19	10	7	6	7	12
SAMPLE SIZE	917	1796	796	351	223	126	132

APPENDIX E': CURRENT JOINT FREQUENCY DISTRIBUTION TABLES

Table E'1

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

July 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	1.54	1.54	0.00	0.00	0.00	0.00	0.00	3.07
NNE	3.07	2.11	0.00	0.00	0.00	0.00	0.00	5.18
NE	4.80	1.92	0.77	0.00	0.00	0.00	0.00	7.49
ENE	4.22	1.15	0.58	0.38	0.00	0.00	0.00	6.33
E	2.30	2.30	0.00	0.00	0.00	0.00	0.00	4.61
ESE	4.03	3.65	0.19	0.00	0.00	0.00	0.00	7.87
SE	1.34	1.54	0.00	0.00	0.00	0.00	0.00	2.88
SSE	2.11	0.96	0.58	0.00	0.00	0.00	0.00	3.65
S	3.84	2.30	0.77	0.00	0.00	0.00	0.00	6.91
SSW	7.68	3.26	0.19	0.00	0.00	0.00	0.00	11.13
SW	2.88	2.11	0.38	0.00	0.00	0.00	0.00	5.37
WSW	6.91	2.88	0.19	0.00	0.00	0.00	0.00	9.98
W	1.73	2.50	0.19	0.00	0.00	0.00	0.00	4.41
WNW	2.88	3.07	1.34	0.19	0.00	0.00	0.00	7.49
NW	2.69	5.18	1.34	0.00	0.00	0.00	0.00	9.21
NNW	1.34	1.92	0.77	0.19	0.19	0.00	0.00	4.41
TOTL	53.36	38.39	7.29	0.77	0.19	0.00	0.00	100.00

* 521 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'2

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

July 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.56	0.75	0.38	0.38	0.19	0.00	0.00	2.26
NNE	0.19	1.51	0.94	0.75	0.38	0.00	0.19	3.95
NE	0.56	2.07	1.51	3.20	1.51	0.19	0.19	9.23
ENE	0.94	2.07	0.56	2.26	3.20	0.56	0.38	9.98
E	0.38	2.07	0.94	2.07	2.07	1.32	0.75	9.60
ESE	0.19	3.77	4.14	1.88	0.75	0.00	0.19	10.92
SE	0.00	1.32	0.38	0.75	0.38	0.19	0.19	3.20
SSE	0.19	1.13	0.94	0.56	0.00	0.00	0.00	2.82
S	0.75	0.38	1.13	0.75	0.38	0.19	0.00	3.58
SSW	0.00	1.13	0.56	0.94	0.19	0.00	0.38	3.20
SW	0.75	1.32	2.45	1.32	0.19	0.00	0.00	6.03
WSW	0.94	2.45	3.58	2.45	0.94	0.19	0.00	10.55
W	1.13	1.51	3.20	2.26	2.07	0.19	0.00	10.36
WNW	0.38	1.88	1.69	0.56	0.00	0.19	0.19	4.90
NW	0.19	1.69	1.69	1.32	0.19	1.13	0.38	6.59
NNW	0.56	0.75	0.56	0.56	0.19	0.19	0.00	2.82
TOTL	7.72	25.80	24.67	22.03	12.62	4.33	2.82	100.00

* 531 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'3

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

August 1975

DIRECTION (TOWARDS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	1.02	0.51	0.25	0.00	0.00	0.00	0.00	1.78
NNE	1.27	2.29	0.25	0.00	0.00	0.00	0.00	3.82
NE	1.53	4.58	1.27	0.00	0.00	0.00	0.00	7.38
ENE	0.51	2.04	1.27	0.00	0.00	0.25	1.02	5.09
E	0.25	2.29	2.80	1.78	0.25	1.27	0.76	9.41
ESE	2.04	1.53	0.00	0.25	0.51	1.27	0.00	5.60
SE	0.76	1.02	0.00	0.51	0.00	0.00	0.00	2.29
SSE	3.31	1.78	0.00	0.00	0.00	0.00	0.00	5.09
S	2.04	3.56	1.02	0.00	0.00	0.00	0.00	6.62
SSW	3.05	3.82	0.25	0.00	0.00	0.00	0.00	7.12
SW	2.04	0.76	0.00	0.00	0.00	0.00	0.00	2.80
WSW	2.04	1.02	0.25	0.00	0.00	0.00	0.00	3.31
W	3.56	1.53	0.51	0.00	0.00	0.00	0.00	5.60
WNW	2.04	7.63	0.25	0.00	0.00	0.00	0.00	9.92
NW	5.09	12.47	3.05	0.00	0.00	0.00	0.00	20.61
NNW	0.76	1.78	1.02	0.00	0.00	0.00	0.00	3.56
TOTL	31.30	48.60	12.21	2.54	0.76	2.80	1.78	100.00

* 393 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'4

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

August 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.14	0.41	0.14	0.00	0.00	0.00	0.00	0.68
NNE	0.54	1.08	0.81	0.14	0.00	0.00	0.00	2.57
NE	0.95	3.65	2.97	0.41	0.27	0.14	0.00	8.38
ENE	0.68	2.16	2.57	0.27	0.00	0.27	2.57	8.51
E	0.81	1.62	2.70	0.54	0.27	0.27	1.62	7.84
ESE	0.54	2.43	1.89	0.81	0.00	0.14	0.00	5.81
SE	0.41	1.89	1.49	0.68	0.00	0.00	0.00	4.46
SSE	0.54	1.35	0.68	0.27	0.27	0.00	0.00	3.11
S	0.81	1.76	1.49	0.68	0.14	0.14	0.14	5.14
SSW	0.68	1.35	2.57	1.22	0.14	0.00	0.14	6.08
SW	0.68	1.08	2.84	0.68	0.81	0.27	0.00	6.35
WSW	0.54	2.30	2.84	0.95	0.54	0.27	0.14	7.57
W	0.68	2.16	2.57	2.03	1.08	0.81	0.54	9.86
WNW	1.35	4.19	2.43	2.16	1.22	0.81	0.81	12.97
NW	0.68	2.16	2.70	1.62	0.54	0.41	0.27	8.38
NNW	0.00	0.81	1.08	0.00	0.41	0.00	0.00	2.30
TOTL	10.00	30.41	31.76	12.43	5.68	3.51	6.22	100.00

* 740 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'5

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

September 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	1.81	0.90	0.00	0.00	0.00	0.00	0.00	2.71
NNE	4.67	2.56	2.86	0.15	0.00	0.00	0.00	10.24
NE	2.71	2.71	2.86	0.45	0.45	0.00	0.00	9.19
ENE	4.07	4.52	4.67	2.56	1.96	0.75	0.00	18.52
E	1.96	1.36	2.71	1.20	0.75	0.30	0.00	8.28
ESE	1.51	0.30	0.15	0.15	0.15	0.15	0.00	2.41
SE	1.66	0.45	0.30	0.30	0.00	0.00	0.00	2.71
SSE	2.41	0.15	0.00	0.00	0.00	0.00	0.00	2.56
S	10.54	0.45	0.15	0.00	0.00	0.00	0.15	11.30
SSW	4.22	0.15	0.00	0.00	0.00	0.00	0.00	4.37
SW	6.63	0.90	0.00	0.00	0.15	0.00	0.15	7.83
WSW	3.16	1.51	0.15	0.00	0.00	0.00	0.00	4.82
W	1.51	1.36	0.75	0.30	0.30	0.45	0.75	5.42
WNW	2.41	2.26	0.00	0.00	0.00	0.00	0.00	4.67
NW	1.05	1.51	0.15	0.00	0.00	0.00	0.00	2.71
NNW	0.75	1.05	0.45	0.00	0.00	0.00	0.00	2.26
TOTL	51.05	22.14	15.21	5.12	3.77	1.66	1.05	100.00

* 664 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'6

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

September 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.79	0.79	0.00	0.00	0.00	0.00	0.00	1.59
NNE	0.40	0.40	1.59	3.17	0.79	0.00	0.00	6.35
NE	1.19	3.17	1.59	3.57	1.59	0.40	0.00	11.51
ENE	0.79	5.16	11.90	9.52	5.56	3.17	0.00	36.11
E	1.19	1.59	4.37	0.79	2.38	1.98	1.19	13.49
ESE	0.40	0.40	0.40	0.00	0.00	0.00	0.00	1.19
SE	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.79
SSE	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.79
S	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.40
SSW	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.40
SW	0.79	0.79	0.40	0.00	0.00	0.00	0.00	1.98
WSW	1.19	5.16	1.59	0.00	0.00	0.00	0.00	7.94
W	1.98	2.78	0.40	0.00	0.00	0.00	0.00	5.16
WNW	1.19	2.78	0.40	0.00	0.00	0.00	0.00	4.37
NW	0.40	2.78	1.19	0.00	0.00	0.00	0.00	4.37
NNW	0.00	2.38	1.19	0.00	0.00	0.00	0.00	3.57
TOTL	11.51	29.37	25.00	17.06	10.32	5.56	1.19	100.00

* 252 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'7

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

October 1975

DIRECTION (TOWARDS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	3.86	2.43	0.00	0.00	0.00	0.00	0.00	6.29
NNE	4.86	0.86	0.00	0.00	0.00	0.00	0.00	5.72
NE	9.59	1.72	0.00	0.00	0.00	0.00	0.00	11.30
ENE	2.15	1.72	0.72	0.29	0.00	0.00	0.00	4.86
E	5.44	0.14	0.29	0.00	0.00	0.00	0.00	5.87
ESE	0.29	0.14	0.00	0.00	0.00	0.00	0.00	0.43
SE	10.73	0.43	0.00	0.00	0.00	0.00	0.00	11.16
SSE	1.29	0.00	0.00	0.00	0.00	0.00	0.00	1.29
S	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.86
SSW	5.58	0.14	0.00	0.00	0.00	0.00	0.00	5.72
SW	16.60	1.57	0.00	0.00	0.14	0.00	0.00	18.31
WSW	6.29	5.29	2.29	0.43	1.00	0.57	0.43	16.31
W	1.43	0.72	0.43	0.57	0.14	0.43	0.57	4.29
WNW	1.43	0.14	0.14	0.00	0.00	0.00	0.00	1.72
NW	2.43	0.86	0.00	0.00	0.00	0.00	0.00	3.29
NNW	2.29	0.29	0.00	0.00	0.00	0.00	0.00	2.58
TOTL	75.11	16.45	3.86	1.29	1.29	1.00	1.00	100.00

* 699 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'8

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

October 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.54	0.54	0.00	0.00	0.00	0.00	0.00	1.07
NNE	1.61	0.80	0.00	0.00	0.00	0.00	0.00	2.41
NE	1.07	4.83	1.34	0.00	0.00	0.00	0.00	7.24
ENE	1.61	8.04	5.09	3.75	1.61	1.61	1.61	23.32
E	1.07	3.22	5.63	1.34	0.80	0.54	0.27	12.87
ESE	1.34	1.61	0.80	0.00	0.00	0.00	0.00	3.75
SE	1.88	1.61	0.54	0.00	0.00	0.00	0.00	4.02
SSE	1.88	0.27	0.00	0.00	0.00	0.00	0.00	2.14
S	0.80	0.27	0.00	0.00	0.00	0.00	0.00	1.07
SSW	1.34	0.27	0.00	0.00	0.00	0.00	0.00	1.61
SW	1.07	1.34	0.27	0.00	0.00	0.00	0.00	2.68
WSW	0.80	3.22	1.61	0.27	0.54	1.88	1.07	9.38
W	2.95	3.49	2.68	3.49	1.07	2.68	3.75	20.11
WNW	1.07	2.68	0.00	0.00	0.00	0.00	0.00	3.75
NW	1.61	1.61	0.00	0.00	0.00	0.00	0.00	3.22
NNW	0.80	0.54	0.00	0.00	0.00	0.00	0.00	1.34
TOTL	21.45	34.32	17.96	8.85	4.02	6.70	6.70	100.00

* 373 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'9

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

November 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.70	0.84	0.00	0.00	0.00	0.00	0.00	1.54
NNE	0.42	0.98	0.14	0.00	0.00	0.00	0.00	1.54
NE	1.82	0.28	0.42	0.42	0.00	0.00	0.00	2.93
ENE	2.79	0.70	0.70	0.70	0.98	0.56	0.98	7.40
E	1.40	0.70	0.00	0.00	0.14	0.14	0.56	2.93
ESE	1.26	0.00	0.00	0.00	0.00	0.00	0.00	1.26
SE	10.06	0.98	0.00	0.00	0.00	0.00	0.00	11.03
SSE	2.23	0.42	0.00	0.00	0.00	0.00	0.00	2.65
S	0.56	0.14	0.00	0.00	0.00	0.00	0.00	0.70
SSW	1.12	0.28	0.00	0.00	0.00	0.00	0.00	1.40
SW	2.65	1.82	0.00	0.00	0.00	0.00	0.00	4.47
WSW	12.85	7.40	0.70	0.70	0.70	0.14	0.14	22.63
W	24.16	0.70	0.28	0.14	0.28	0.14	0.00	25.70
WNW	11.31	0.28	0.14	0.00	0.00	0.00	0.00	11.73
NW	1.12	0.14	0.00	0.00	0.00	0.00	0.00	1.26
NNW	0.70	0.14	0.00	0.00	0.00	0.00	0.00	0.84
TOTL	75.14	15.78	2.37	1.96	2.09	0.98	1.68	100.00

* 716 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'10

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

November 1975

DIRECTION (TOWARDS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.42	0.98	0.00	0.00	0.00	0.00	0.00	1.40
NNE	0.14	1.26	0.56	0.00	0.00	0.00	0.00	1.96
NE	0.70	2.51	1.54	0.56	0.56	0.00	0.28	6.15
ENE	1.54	1.96	2.65	1.68	1.82	1.96	5.03	16.62
E	0.84	3.91	4.19	3.91	1.96	1.26	4.75	20.81
ESE	0.56	1.54	0.70	0.14	0.14	0.00	0.00	3.07
SE	0.28	0.84	0.00	0.00	0.00	0.00	0.00	1.12
SSE	0.70	0.70	0.00	0.00	0.00	0.00	0.00	1.40
S	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.28
SSW	0.98	0.42	0.00	0.00	0.00	0.00	0.00	1.40
SW	0.56	0.84	0.00	0.00	0.00	0.00	0.00	1.40
WSW	1.26	0.56	0.28	0.84	0.28	0.28	0.28	3.77
W	1.82	2.51	5.17	2.37	1.40	1.12	0.56	14.94
WNW	1.54	4.89	2.93	1.96	1.12	0.42	1.40	14.25
NW	1.54	3.21	1.96	0.70	0.28	0.14	0.14	7.96
NNW	1.26	2.09	0.14	0.00	0.00	0.00	0.00	3.49
TOTL	14.39	28.21	20.11	12.15	7.54	5.17	12.43	100.00

* 716 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'11

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

December 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	2.02	0.40	0.13	0.00	0.00	0.00	0.00	2.55
NNE	1.48	0.40	0.00	0.00	0.00	0.00	0.00	1.88
NE	0.94	0.94	0.13	0.00	0.00	0.00	0.00	2.02
ENE	1.08	0.13	0.13	0.13	0.13	0.40	0.94	2.96
E	1.48	0.13	0.00	0.00	0.00	0.00	0.00	1.61
ESE	11.83	0.27	0.00	0.00	0.00	0.13	0.00	12.23
SE	2.69	0.27	0.00	0.00	0.00	0.00	0.00	2.96
SSE	6.99	0.27	0.00	0.00	0.00	0.00	0.00	7.26
S	6.59	0.13	0.00	0.00	0.00	0.00	0.00	6.72
SSW	3.36	0.27	0.00	0.00	0.00	0.00	0.00	3.63
SW	3.36	1.34	0.00	0.00	0.00	0.00	0.00	4.70
WSW	8.33	2.15	0.00	0.00	0.00	0.00	0.00	10.48
W	19.22	0.94	0.00	0.00	0.00	0.00	0.00	20.16
WNW	11.29	1.48	0.13	0.00	0.00	0.00	0.00	12.90
NW	4.70	1.08	0.13	0.00	0.00	0.00	0.00	5.91
NNW	1.88	0.13	0.00	0.00	0.00	0.00	0.00	2.02
TOTL	87.23	10.35	0.67	0.13	0.13	0.54	0.94	100.00

* 744 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'12

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

December 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.13
NNE	4.44	3.36	0.40	0.00	0.00	0.00	0.00	8.20
NE	0.40	0.67	0.94	0.00	0.13	0.00	0.00	2.15
ENE	0.54	3.09	4.70	6.99	4.57	2.82	2.28	25.00
E	3.49	6.59	5.65	9.54	7.66	6.59	5.65	45.16
ESE	0.27	0.13	0.13	0.00	0.00	0.00	0.00	0.54
SE	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.13
SSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.27
SW	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.13
WSW	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.13
W	1.88	2.02	2.15	1.34	0.67	0.27	0.00	8.33
WNW	0.67	2.02	1.88	1.21	0.94	0.00	0.00	6.72
NW	0.13	1.21	0.00	0.00	0.00	0.00	0.00	1.34
NNW	0.27	0.67	0.27	0.27	0.13	0.00	0.13	1.75
TOTL	12.63	20.03	16.13	19.35	14.11	9.68	8.06	100.00

* 744 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'13

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

July to December 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	1.90	1.12	0.05	0.00	0.00	0.00	0.00	3.08
NNE	2.68	1.42	0.56	0.03	0.00	0.00	0.00	4.68
NE	3.64	1.79	0.86	0.16	0.08	0.00	0.00	6.53
ENE	2.52	1.66	1.34	0.72	0.56	0.35	0.48	7.63
E	2.27	0.99	0.83	0.40	0.19	0.21	0.19	5.08
ESE	3.69	0.80	0.05	0.05	0.08	0.19	0.00	4.87
SE	5.03	0.72	0.05	0.11	0.00	0.00	0.00	5.91
SSE	3.13	0.48	0.08	0.00	0.00	0.00	0.00	3.69
S	4.20	0.83	0.24	0.00	0.00	0.00	0.03	5.30
SSW	4.07	1.02	0.05	0.00	0.00	0.00	0.00	5.14
SW	6.07	1.45	0.05	0.00	0.05	0.00	0.03	7.65
WSW	7.04	3.61	0.64	0.21	0.32	0.13	0.11	12.07
W	9.61	1.20	0.35	0.19	0.13	0.19	0.24	11.91
WNW	5.73	2.01	0.29	0.03	0.00	0.00	0.00	8.05
NW	2.70	2.70	0.56	0.00	0.00	0.00	0.00	5.97
NNW	1.34	0.75	0.29	0.03	0.03	0.00	0.00	2.44
TOTL	65.61	22.56	6.32	1.93	1.45	1.07	1.07	100.00

*3737 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'14

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

July to December 1975

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.33	0.57	0.09	0.06	0.03	0.00	0.00	1.07
NNE	1.37	1.61	0.66	0.39	0.12	0.00	0.03	4.17
NE	0.74	2.59	1.70	0.98	0.57	0.09	0.09	6.76
ENE	0.98	3.19	3.72	3.46	2.50	1.61	2.38	17.85
E	1.40	3.46	3.84	3.61	2.77	2.21	2.86	20.14
ESE	0.51	1.70	1.37	0.51	0.15	0.03	0.03	4.29
SE	0.42	1.01	0.45	0.27	0.06	0.03	0.03	2.26
SSE	0.54	0.69	0.30	0.15	0.06	0.00	0.00	1.73
S	0.48	0.48	0.51	0.27	0.09	0.06	0.03	1.91
SSW	0.57	0.63	0.66	0.42	0.06	0.00	0.09	2.41
SW	0.60	0.83	1.07	0.36	0.21	0.06	0.00	3.13
WSW	0.72	1.79	1.55	0.80	0.39	0.36	0.21	5.81
W	1.61	2.29	2.98	2.00	1.13	0.80	0.66	11.47
WNW	1.04	3.22	1.88	1.25	0.72	0.30	0.51	8.91
NW	0.74	2.09	1.37	0.72	0.21	0.30	0.15	5.57
NNW	0.51	1.13	0.51	0.15	0.15	0.03	0.03	2.50
TOTL	12.54	27.26	22.65	15.38	9.21	5.87	7.09	100.00

*3356 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'15

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

January 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.40	0.54	0.00	0.00	0.00	0.00	0.00	0.94
NNE	28.76	2.02	0.00	0.00	0.00	0.00	0.00	30.78
NE	3.09	2.15	0.13	0.13	0.00	0.00	0.00	5.51
ENE	0.40	1.08	0.27	0.13	0.13	0.00	0.00	2.02
E	1.21	0.00	0.00	0.00	0.00	0.00	0.00	1.21
ESE	0.94	0.40	0.00	0.00	0.00	0.00	0.00	1.34
SE	1.08	0.27	0.00	0.00	0.00	0.00	0.00	1.34
SSE	6.99	0.81	0.00	0.00	0.00	0.00	0.00	7.80
S	7.53	1.08	0.00	0.00	0.00	0.00	0.00	8.60
SSW	6.18	0.54	0.00	0.00	0.00	0.00	0.00	6.72
SW	19.35	3.49	0.13	0.00	0.00	0.00	0.00	22.98
WSW	0.54	1.08	0.13	0.00	0.00	0.00	0.00	1.75
W	2.15	1.08	0.00	0.00	0.00	0.00	0.00	3.23
WNW	0.67	0.94	0.00	0.00	0.00	0.00	0.00	1.61
NW	0.94	2.15	0.00	0.00	0.00	0.13	0.00	3.23
NNW	0.67	0.13	0.13	0.00	0.00	0.00	0.00	0.94
TOTL	80.91	17.74	0.81	0.27	0.13	0.13	0.00	100.00

* 744 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'16

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

January 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.13
NNE	0.67	1.34	0.13	0.00	0.00	0.00	0.00	2.15
NE	1.34	1.48	0.81	0.13	0.00	0.00	0.00	3.76
ENE	0.40	1.75	3.76	2.82	2.42	3.36	3.76	18.28
E	0.40	1.88	6.18	6.32	6.45	2.55	4.84	28.63
ESE	0.00	0.81	1.08	1.08	0.94	0.13	0.13	4.17
SE	0.27	0.54	0.54	0.00	0.00	0.00	0.00	1.34
SSE	0.00	0.54	0.40	0.00	0.00	0.00	0.00	0.94
S	0.00	0.81	0.13	0.00	0.00	0.00	0.00	0.94
SSW	0.00	0.40	0.54	0.00	0.00	0.00	0.00	0.94
SW	0.27	0.27	0.13	0.00	0.00	0.00	0.00	0.67
WSW	0.54	0.67	0.40	0.27	0.00	0.00	0.00	1.88
W	2.02	3.09	2.28	1.61	1.48	0.81	0.00	11.29
WNW	10.75	6.99	2.15	0.13	0.27	0.40	0.13	20.83
NW	0.54	1.21	0.00	0.00	0.00	0.00	0.00	1.75
NNW	0.27	0.81	0.94	0.27	0.00	0.00	0.00	2.28
TOTL	17.47	22.72	19.49	12.63	11.56	7.26	8.87	100.00

* 744 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'17

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

February 1976

DIRECTION (TOWARDS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	18.93	2.75	0.00	0.00	0.00	0.00	0.00	21.69
NNE	0.17	0.34	0.00	0.00	0.00	0.00	0.00	0.52
NE	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.17
ENE	3.96	0.52	0.00	0.00	0.00	0.00	0.00	4.48
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	11.53	1.55	0.34	0.00	0.00	0.00	0.00	13.43
WSW	47.16	8.43	1.20	0.00	0.00	0.00	0.00	56.80
W	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.34	0.34	0.00	0.00	0.00	0.00	0.00	0.69
NW	0.69	0.34	0.00	0.00	0.00	0.00	0.00	1.03
NNW	0.52	0.69	0.00	0.00	0.00	0.00	0.00	1.20
TOTL	83.48	14.97	1.55	0.00	0.00	0.00	0.00	100.00

* 581 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'18

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

February 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.15
NNE	0.30	0.59	0.15	0.00	0.00	0.00	0.00	1.04
NE	1.78	0.89	0.15	0.00	0.15	0.00	0.00	2.97
ENE	1.04	4.75	6.09	7.88	4.31	2.67	1.49	28.23
E	0.30	1.63	4.46	3.27	5.35	4.31	6.09	25.41
ESE	0.30	0.74	1.19	0.74	0.30	0.15	0.00	3.42
SE	0.00	0.45	0.15	0.00	0.00	0.00	0.00	0.59
SSE	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.15
S	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.30
SSW	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.59
SW	1.04	0.59	0.00	0.00	0.00	0.00	0.00	1.63
WSW	0.59	0.45	0.45	0.00	0.00	0.00	0.00	1.49
W	4.31	4.90	2.67	2.23	0.30	0.59	0.00	15.01
WNW	5.79	5.35	2.08	0.45	1.19	0.89	0.89	16.64
NW	1.34	0.45	0.00	0.00	0.00	0.00	0.00	1.78
NNW	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.59
TOTL	17.83	21.55	17.38	14.56	11.59	8.62	8.47	100.00

* 673 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'19

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

March 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.63
NE	3.77	10.69	0.00	0.00	0.00	0.00	0.00	14.47
ENE	2.52	48.43	22.64	1.89	1.26	1.26	0.00	77.99
E	0.00	1.89	0.00	0.00	0.63	0.00	0.00	2.52
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.63
NW	2.52	0.63	0.00	0.00	0.00	0.00	0.00	3.14
NNW	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.63
TOTL	8.81	63.52	22.64	1.89	1.89	1.26	0.00	100.00

* 159 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'20

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

March 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.63	0.00	0.00	0.00	0.00	0.63
NE	1.26	6.29	0.63	0.00	0.00	0.00	0.00	8.18
ENE	13.21	21.38	13.21	1.89	2.52	0.00	0.00	52.20
E	11.95	11.32	8.18	0.00	0.00	0.63	0.63	32.70
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.63	0.63	0.00	0.00	0.00	0.63	1.26	3.14
NW	0.63	1.26	0.00	0.00	0.00	0.00	0.00	1.89
NNW	0.63	0.63	0.00	0.00	0.00	0.00	0.00	1.26
TOTL	28.30	41.51	22.64	1.89	2.52	1.26	1.89	100.00

* 159 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'21

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

April 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.43	0.29	0.00	0.00	0.00	0.00	0.00	0.72
NNE	3.43	0.72	0.00	0.00	0.00	0.00	0.00	4.15
NE	17.45	6.15	0.00	0.00	0.00	0.00	0.00	23.61
ENE	1.14	9.87	7.44	1.43	0.29	0.00	0.00	20.17
E	0.43	1.72	0.14	0.14	0.00	0.00	0.00	2.43
ESE	0.29	0.29	0.00	0.00	0.00	0.00	0.00	0.57
SE	0.43	0.43	0.00	0.00	0.00	0.00	0.00	0.86
SSE	0.14	0.43	0.00	0.00	0.00	0.00	0.00	0.57
S	3.86	0.57	0.00	0.00	0.00	0.00	0.00	4.43
SSW	0.43	0.72	0.00	0.00	0.00	0.00	0.00	1.14
SW	1.00	0.57	0.00	0.00	0.00	0.00	0.00	1.57
WSW	2.43	2.58	0.00	0.00	0.00	0.00	0.00	5.01
W	3.58	4.58	1.57	0.57	0.00	0.00	0.00	10.30
WNW	2.58	3.72	2.72	0.72	0.14	0.00	0.00	9.87
NW	2.15	1.00	0.14	0.00	0.00	0.00	0.00	3.29
NNW	8.30	3.00	0.00	0.00	0.00	0.00	0.00	11.30
TOTL	48.07	36.62	12.02	2.86	0.43	0.00	0.00	100.00

* 699 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'22

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

April 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	2.36	0.64	0.00	0.00	0.00	0.00	0.00	3.00
NNE	2.57	1.28	0.00	0.00	0.00	0.00	0.00	3.85
NE	6.42	3.21	0.00	0.00	0.00	0.00	0.00	9.64
ENE	3.85	11.35	4.28	2.78	0.86	0.00	0.00	23.13
E	7.92	5.78	1.93	1.50	0.86	0.21	0.00	18.20
ESE	2.78	0.86	0.00	0.00	0.00	0.00	0.00	3.64
SE	0.86	0.64	0.00	0.00	0.00	0.00	0.00	1.50
SSE	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.86
S	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.21
SSW	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.43
SW	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.21
WSW	2.14	1.28	0.00	0.00	0.00	0.00	0.00	3.43
W	4.93	9.42	1.50	0.86	0.21	0.00	0.00	16.92
WNW	3.64	1.71	0.64	0.43	0.64	0.00	0.00	7.07
NW	2.36	1.93	0.00	0.00	0.00	0.00	0.00	4.28
NNW	2.78	0.86	0.00	0.00	0.00	0.00	0.00	3.64
TOTL	44.33	38.97	8.35	5.57	2.57	0.21	0.00	100.00

* 467 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'23

Joint Frequence Distribution* of Current Speed and Direction

1 M Above Bottom

May 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.70	0.28	0.00	0.00	0.00	0.00	0.00	0.98
NNE	0.98	1.12	0.00	0.00	0.00	0.00	0.00	2.10
NE	0.84	4.34	0.28	0.00	0.00	0.00	0.00	5.46
ENE	3.78	17.51	4.48	4.34	4.20	0.28	0.00	34.59
E	2.10	3.64	0.70	0.70	0.42	0.00	0.00	7.56
ESE	0.56	0.42	0.00	0.00	0.00	0.00	0.00	0.98
SE	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.14
SSE	0.28	0.14	0.00	0.00	0.00	0.00	0.00	0.42
S	0.14	0.28	0.00	0.00	0.00	0.00	0.00	0.42
SSW	2.10	3.64	0.00	0.00	0.00	0.00	0.00	5.74
SW	6.44	2.52	0.00	0.00	0.00	0.00	0.00	8.96
WSW	2.80	0.70	0.00	0.00	0.00	0.00	0.00	3.50
W	0.70	2.80	0.70	0.00	0.00	0.00	0.00	4.20
WNW	6.16	7.14	0.28	0.00	0.00	0.00	0.00	13.59
NW	5.18	2.38	0.00	0.00	0.00	0.00	0.00	7.56
NNW	1.96	1.82	0.00	0.00	0.00	0.00	0.00	3.78
TOTL	34.73	48.88	6.44	5.04	4.62	0.28	0.00	100.00

* 714 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'24

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

May 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.22	2.38	0.00	0.00	0.00	0.00	0.00	2.59
NNE	0.65	2.38	0.00	0.00	0.00	0.00	0.00	3.02
NE	1.73	7.34	0.86	0.00	0.00	0.00	0.00	9.94
ENE	1.08	11.88	7.99	1.51	0.00	0.00	0.00	22.46
E	0.65	3.46	0.86	0.00	0.00	0.00	0.00	4.97
ESE	1.30	0.86	0.00	0.00	0.00	0.00	0.00	2.16
SE	1.08	1.73	0.00	0.00	0.00	0.00	0.00	2.81
SSE	0.86	3.24	0.00	0.00	0.00	0.00	0.00	4.10
S	1.08	3.46	0.00	0.00	0.00	0.00	0.00	4.54
SSW	0.65	3.67	0.22	0.00	0.00	0.00	0.00	4.54
SW	1.08	3.24	0.00	0.00	0.00	0.00	0.00	4.32
WSW	2.59	5.83	0.00	0.00	0.00	0.00	0.00	8.42
W	1.73	4.10	0.00	0.00	0.00	0.00	0.00	5.83
WNW	1.51	4.75	0.00	0.00	0.00	0.00	0.00	6.26
NW	1.73	7.78	0.43	0.00	0.00	0.00	0.00	9.94
NNW	0.43	2.59	1.08	0.00	0.00	0.00	0.00	4.10
TOTL	18.36	68.68	11.45	1.51	0.00	0.00	0.00	100.00

* 463 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'25

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

June 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	1.86	3.15	0.00	0.00	0.00	0.00	0.00	5.01
NNE	2.01	2.29	0.29	0.00	0.00	0.00	0.00	4.58
NE	1.00	1.43	1.29	0.00	0.00	0.00	0.00	3.72
ENE	1.29	2.15	0.86	0.14	0.00	0.00	0.00	4.44
E	0.86	1.15	0.00	0.00	0.00	0.00	0.00	2.01
ESE	0.57	2.29	0.00	0.00	0.00	0.00	0.00	2.87
SE	0.43	0.86	0.00	0.00	0.00	0.00	0.00	1.29
SSE	0.14	1.58	0.00	0.00	0.00	0.00	0.00	1.72
S	0.57	0.86	0.43	0.00	0.00	0.00	0.00	1.86
SSW	0.43	0.72	0.29	0.00	0.00	0.00	0.00	1.43
SW	2.58	5.59	0.43	0.00	0.00	0.00	0.00	8.60
WSW	2.87	3.58	0.00	0.00	0.00	0.00	0.00	6.45
W	10.60	3.87	0.14	0.00	0.00	0.00	0.00	14.61
WNW	6.88	2.44	0.00	0.00	0.00	0.00	0.00	9.31
NW	7.02	8.31	0.14	0.00	0.00	0.00	0.00	15.47
NNW	6.30	8.88	1.29	0.14	0.00	0.00	0.00	16.62
TOTL	45.42	49.14	5.16	0.29	0.00	0.00	0.00	100.00

* 698 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'26

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

June 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.57	1.43	0.57	0.00	0.00	0.00	0.00	2.58
NNE	1.58	4.01	1.43	0.14	0.00	0.00	0.00	7.16
NE	0.14	3.72	2.58	1.15	0.00	0.00	0.00	7.59
ENE	1.29	3.30	2.01	0.86	1.00	0.14	0.00	8.60
E	0.86	2.87	1.86	1.00	0.14	0.00	0.00	6.73
ESE	0.29	3.15	1.58	0.00	0.00	0.00	0.00	5.01
SE	0.86	1.15	0.14	0.00	0.00	0.00	0.00	2.15
SSE	0.86	2.72	1.15	0.00	0.00	0.00	0.00	4.73
S	0.86	3.15	0.86	0.29	0.00	0.00	0.00	5.16
SSW	0.86	2.58	2.29	0.14	0.00	0.00	0.00	5.87
SW	0.86	1.86	2.87	0.00	0.00	0.00	0.00	5.59
WSW	1.58	4.01	0.72	0.00	0.00	0.00	0.00	6.30
W	2.44	4.44	0.14	0.00	0.00	0.00	0.00	7.02
WNW	1.86	7.45	0.29	0.00	0.00	0.00	0.00	9.60
NW	2.15	6.16	2.15	0.57	0.00	0.00	0.00	11.03
NNW	1.43	2.87	0.29	0.29	0.00	0.00	0.00	4.87
TOTL	18.48	54.87	20.92	4.44	1.15	0.14	0.00	100.00

* 698 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'27

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

July 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	3.59	3.59	0.00	0.00	0.00	0.00	0.00	7.18
NNE	3.59	4.10	0.00	0.00	0.00	0.00	0.00	7.69
NE	3.59	13.85	4.10	0.51	0.00	0.00	0.00	22.05
ENE	5.13	17.44	6.15	0.51	0.00	0.00	0.00	29.23
E	0.51	1.03	0.00	0.00	0.00	0.00	0.00	1.54
ESE	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.51
SE	1.03	0.00	0.00	0.00	0.00	0.00	0.00	1.03
SSE	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.51
S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	2.05	0.00	0.00	0.00	0.00	0.00	0.00	2.05
SW	2.05	0.00	0.00	0.00	0.00	0.00	0.00	2.05
WSW	4.62	1.03	0.00	0.00	0.00	0.00	0.00	5.64
W	6.15	1.03	0.00	0.00	0.00	0.00	0.00	7.18
WNW	4.10	1.03	0.00	0.00	0.00	0.00	0.00	5.13
NW	2.05	1.54	0.00	0.00	0.00	0.00	0.00	3.59
NNW	0.51	4.10	0.00	0.00	0.00	0.00	0.00	4.62
TOTL	39.49	49.23	10.26	1.03	0.00	0.00	0.00	100.00

* 195 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'28

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

July 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	1.22	1.22	0.00	0.00	0.00	0.00	0.00	2.44
NNE	1.22	5.14	1.08	0.00	0.00	0.00	0.00	7.44
NE	1.49	5.01	3.65	0.14	0.00	0.00	0.00	10.28
ENE	1.49	7.31	9.34	3.11	0.68	0.00	0.00	21.92
E	1.76	4.06	2.84	0.54	0.14	0.00	0.00	[illegible].34
ESE	1.08	1.22	0.00	0.00	0.00	0.00	0.00	2.30
SE	1.08	2.30	0.00	0.00	0.00	0.00	0.00	3.38
SSE	1.49	2.44	0.41	0.00	0.00	0.00	0.00	4.33
S	1.62	1.62	0.14	0.00	0.00	0.00	0.00	3.38
SSW	1.89	2.03	0.00	0.00	0.00	0.00	0.00	3.92
SW	2.03	1.22	0.41	0.00	0.00	0.00	0.00	3.65
WSW	1.62	3.11	0.41	0.00	0.00	0.00	0.00	5.14
W	1.49	3.11	0.27	0.14	0.00	0.00	0.00	5.01
WNW	1.35	3.11	1.35	0.14	0.00	0.00	0.00	5.95
NW	1.35	4.74	0.41	0.27	0.00	0.00	0.00	6.77
NNW	1.35	2.84	0.54	0.00	0.00	0.00	0.00	4.74
TOTL	23.55	50.47	20.84	4.33	0.81	0.00	0.00	100.00

* 739 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'29

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

August 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	1.21	0.27	0.00	0.00	0.00	0.00	0.00	1.48
NNE	1.34	2.15	0.00	0.00	0.00	0.00	0.00	3.49
NE	2.28	1.08	0.00	0.00	0.00	0.00	0.00	3.36
ENE	1.88	1.21	0.13	0.00	0.00	0.00	0.00	3.23
E	2.42	0.54	0.00	0.00	0.00	0.00	0.00	2.96
ESE	2.28	0.54	0.00	0.00	0.00	0.00	0.00	2.82
SE	2.42	1.75	0.00	0.00	0.00	0.00	0.00	4.17
SSE	2.82	1.21	0.00	0.00	0.00	0.00	0.00	4.03
S	4.44	1.48	0.00	0.00	0.00	0.00	0.00	5.91
SSW	6.72	2.15	0.00	0.00	0.00	0.00	0.00	8.87
SW	7.80	5.78	0.00	0.00	0.00	0.00	0.00	13.58
WSW	6.59	6.05	0.00	0.00	0.00	0.00	0.00	12.63
W	6.72	5.11	0.13	0.00	0.00	0.00	0.00	11.96
WNW	4.44	6.59	0.13	0.00	0.00	0.00	0.00	11.16
NW	4.17	3.36	0.00	0.00	0.00	0.00	0.00	7.53
NNW	1.48	1.34	0.00	0.00	0.00	0.00	0.00	2.82
TOTL	59.01	40.59	0.40	0.00	0.00	0.00	0.00	100.00

* 744 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'30

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

August 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.50
NNE	0.25	0.50	0.00	0.00	0.50	0.00	0.00	1.26
NE	0.25	1.51	0.00	0.00	0.00	0.25	0.00	2.01
ENE	0.25	0.75	0.25	0.25	0.75	0.25	0.00	2.51
E	0.00	3.02	0.25	0.00	0.50	0.25	0.00	4.02
ESE	0.00	3.27	0.50	0.00	0.25	0.25	0.25	4.52
SE	0.75	2.76	1.26	0.50	0.00	0.00	0.00	5.28
SSE	0.00	2.51	0.25	0.00	0.00	0.00	0.00	2.76
S	1.01	1.26	0.75	0.00	0.00	0.00	0.00	3.02
SSW	0.75	3.77	4.02	0.75	0.25	0.00	0.00	9.55
SW	1.51	5.78	3.77	5.03	0.00	0.25	0.00	16.33
WSW	0.75	6.28	11.31	5.53	3.52	1.01	1.01	29.40
W	0.00	4.77	2.01	1.51	0.50	0.25	0.25	9.30
WNW	0.25	2.26	1.01	0.75	0.50	0.00	0.00	4.77
NW	0.25	1.26	1.01	0.75	0.25	0.00	0.00	3.52
NNW	0.50	0.25	0.25	0.00	0.25	0.00	0.00	1.26
TOTL	6.78	40.20	26.63	15.08	7.29	2.51	1.51	100.00

* 398 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'31

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

September 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	1.27	0.95	0.32	0.00	0.00	0.00	0.00	2.53
NNE	1.58	1.58	0.00	0.00	0.00	0.00	0.00	3.16
NE	1.90	6.33	0.32	0.32	0.00	0.00	0.00	8.86
ENE	3.80	9.81	3.16	0.00	0.00	0.00	0.00	16.77
E	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.32
ESE	0.32	0.32	0.00	0.00	0.00	0.00	0.00	0.63
SE	0.00	2.22	0.00	0.00	0.00	0.00	0.00	2.22
SSE	0.63	1.90	0.00	0.00	0.00	0.00	0.00	2.53
S	3.80	1.90	0.00	0.00	0.00	0.00	0.00	5.70
SSW	4.11	1.58	0.00	0.00	0.00	0.00	0.00	5.70
SW	3.48	4.43	0.00	0.00	0.00	0.00	0.00	7.91
WSW	6.01	2.53	0.00	0.00	0.00	0.00	0.00	8.54
W	3.16	2.53	0.32	0.00	0.00	0.00	0.00	6.01
WNW	6.65	9.18	0.32	0.00	0.00	0.00	0.00	16.14
NW	4.11	7.59	0.00	0.00	0.00	0.00	0.00	11.71
NNW	0.32	0.95	0.00	0.00	0.00	0.00	0.00	1.27
TOTL	41.46	53.80	4.43	0.32	0.00	0.00	0.00	100.00

* 316 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'32

Joint Frequency Distribution* of Current Speed and Direction

1 M Above Bottom

January to August 1976

DIRECTION (TOWARDS)	SPEED, M/SEC <.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	3.18	1.20	0.02	0.00	0.00	0.00	0.00	4.39
NNE	5.81	1.57	0.04	0.00	0.00	0.00	0.00	7.42
NE	4.02	3.55	0.43	0.06	0.00	0.00	0.00	8.06
ENE	2.27	7.65	3.11	0.97	0.72	0.08	0.00	14.80
E	1.09	1.13	0.12	0.12	0.08	0.00	0.00	2.56
ESE	0.72	0.62	0.00	0.00	0.00	0.00	0.00	1.34
SE	0.70	0.66	0.00	0.00	0.00	0.00	0.00	1.36
SSE	1.65	0.74	0.00	0.00	0.00	0.00	0.00	2.39
S	2.74	0.76	0.06	0.00	0.00	0.00	0.00	3.57
SSW	2.76	1.26	0.04	0.00	0.00	0.00	0.00	4.06
SW	7.32	3.15	0.12	0.00	0.00	0.00	0.00	10.60
WSW	8.49	3.30	0.16	0.00	0.00	0.00	0.00	11.96
W	3.96	2.78	0.39	0.08	0.00	0.00	0.00	7.22
WNW	3.69	3.79	0.47	0.10	0.02	0.00	0.00	8.08
NW	3.38	3.15	0.04	0.00	0.00	0.02	0.00	6.60
NNW	2.82	2.54	0.21	0.02	0.00	0.00	0.00	5.59
TOTL	54.62	37.86	5.24	1.36	0.82	0.10	0.00	100.00

*4850 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table E'33

Joint Frequency Distribution* of Current Speed and Direction

3 M Above Bottom

January to August 1976

DIRECTION (TOWARDS)	SPEED, M/SEC							
	<.03	.03-.08	.08-.12	.12-.17	.17-.21	.21-.26	>.26	TOTAL
N	0.62	0.81	0.09	0.00	0.00	0.00	0.00	1.52
NNE	0.99	2.28	0.48	0.02	0.05	0.00	0.00	3.82
NE	1.73	3.34	1.31	0.23	0.02	0.02	0.00	6.66
ENE	1.73	6.15	5.32	2.93	1.61	1.04	0.88	19.65
E	1.91	3.41	3.16	2.00	2.12	1.17	1.80	15.57
ESE	0.71	1.45	0.67	0.30	0.23	0.07	0.05	3.48
SE	0.65	1.24	0.25	0.05	0.00	0.00	0.00	2.19
SSE	0.58	1.54	0.35	0.00	0.00	0.00	0.00	2.46
S	0.65	1.45	0.25	0.05	0.00	0.00	0.00	2.40
SSW	0.74	1.57	0.85	0.09	0.02	0.00	0.00	3.27
SW	0.97	1.52	0.90	0.46	0.00	0.02	0.00	3.87
WSW	1.29	2.70	1.36	0.55	0.32	0.09	0.09	6.40
W	2.37	4.42	1.22	0.88	0.37	0.25	0.02	9.54
WNW	3.87	4.68	1.13	0.23	0.35	0.23	0.21	10.69
NW	1.36	3.27	0.55	0.21	0.02	0.00	0.00	5.41
NNW	0.97	1.54	0.44	0.09	0.02	0.00	0.00	3.06
TOTL	21.12	41.37	18.34	8.09	5.14	2.90	3.04	100.00

*4341 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

APPENDIX F': MONTHLY CURRENT AND WIND ROSES

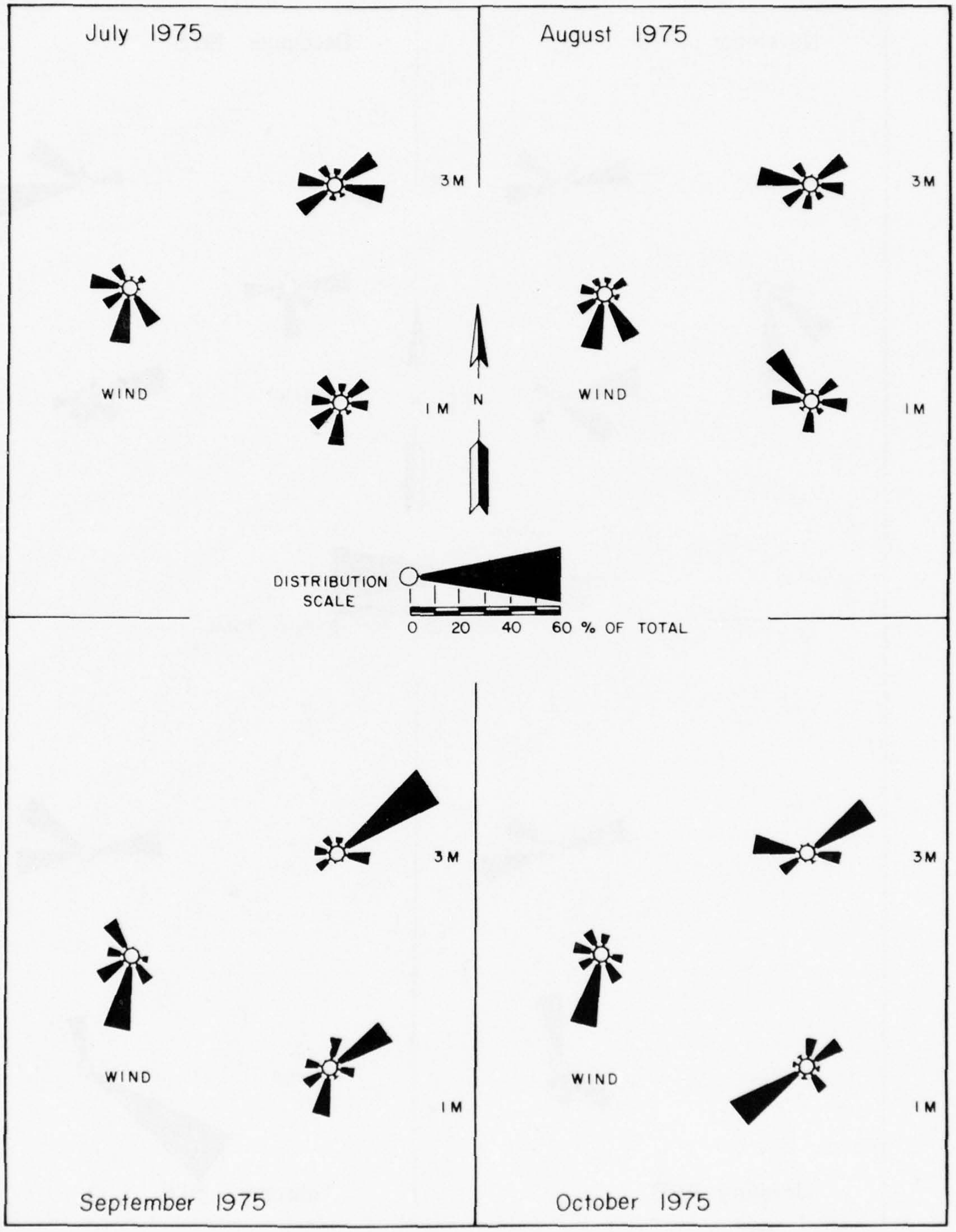

Figure F'1. Monthly current roses and wind roses, July 1975-October 1975; current distributions are "towards" and wind directions are "from"

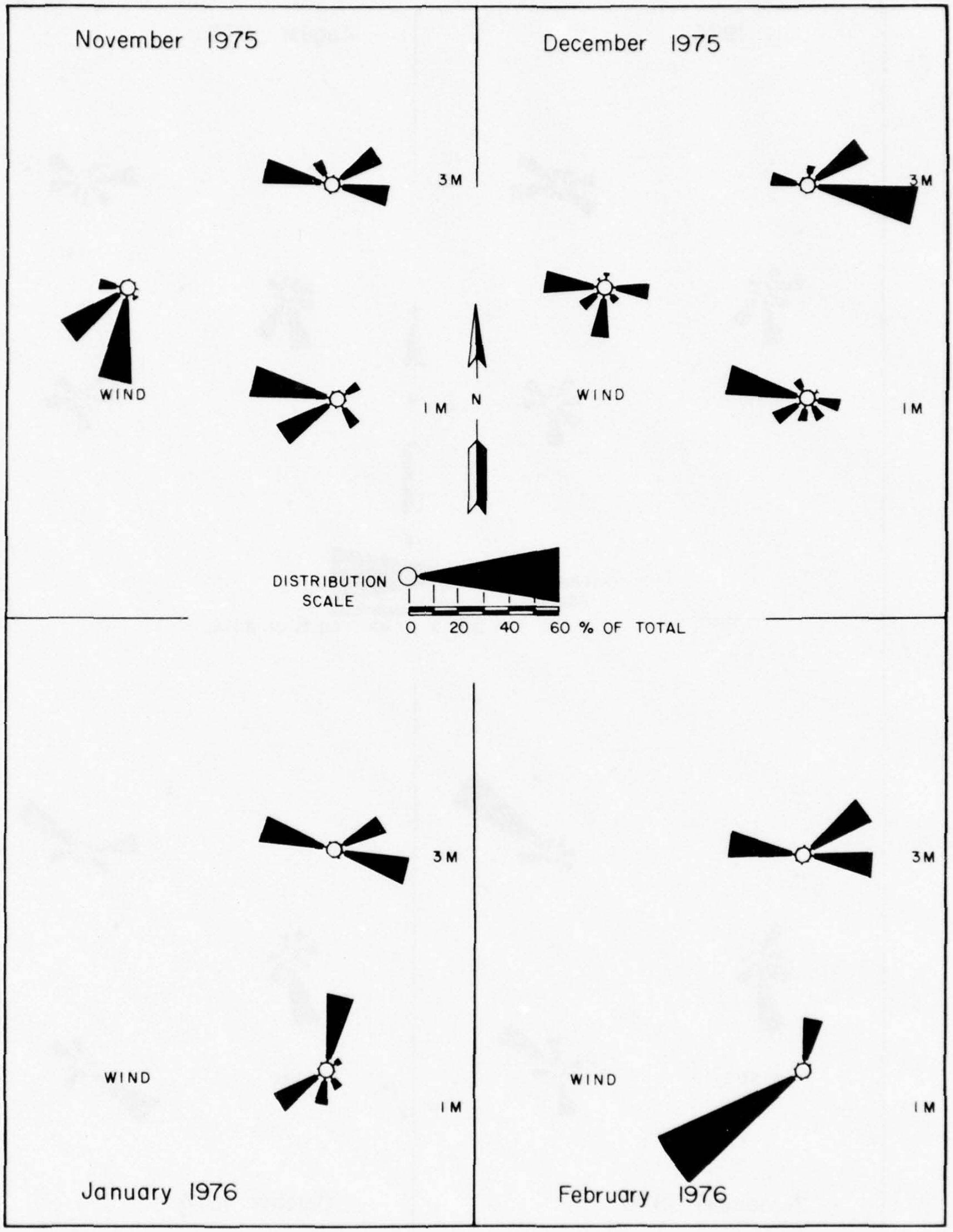

Figure F'2. Monthly current roses and wind roses, November 1975
February 1976

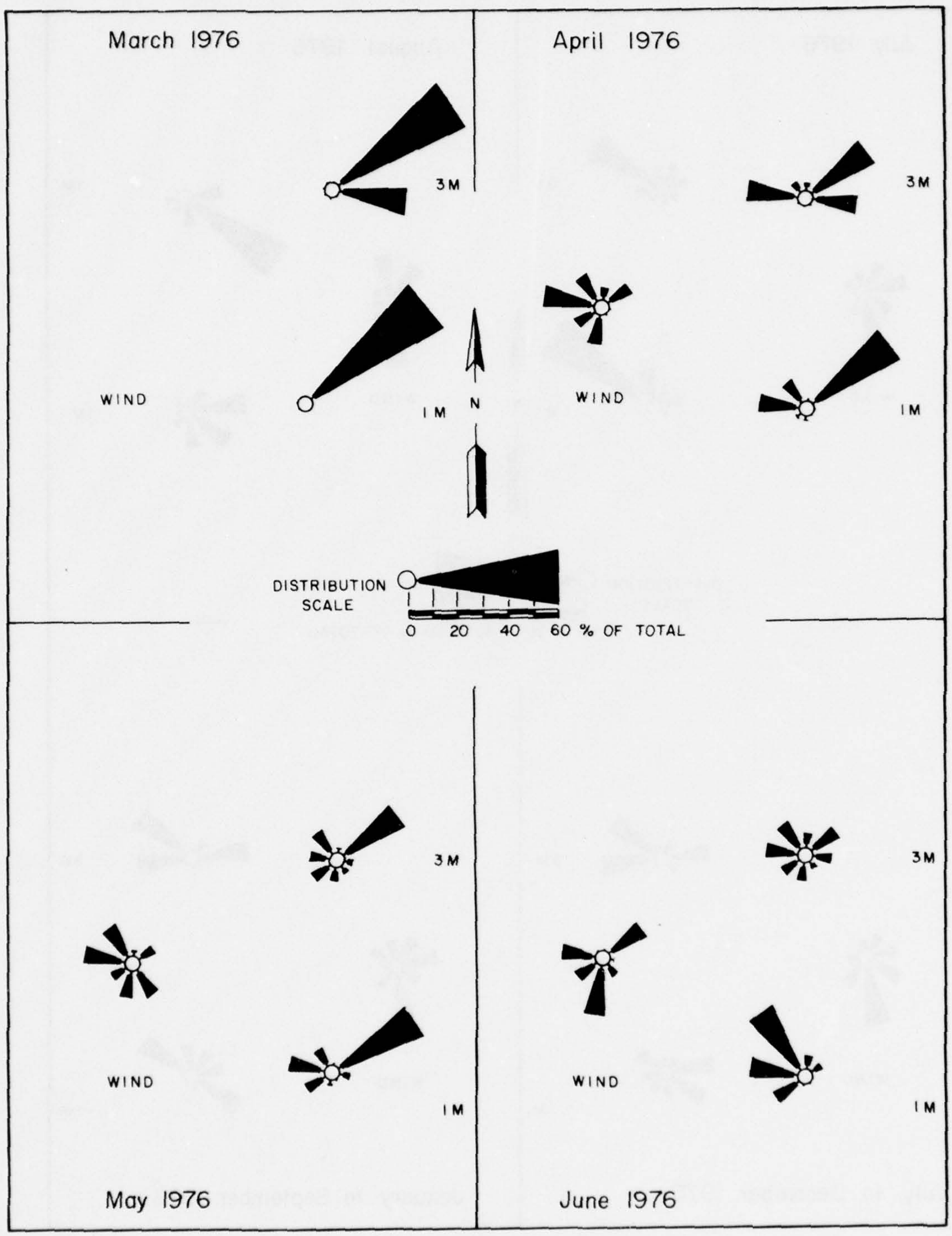

Figure F'3. Monthly current roses and wind roses, March 1976-June 1976

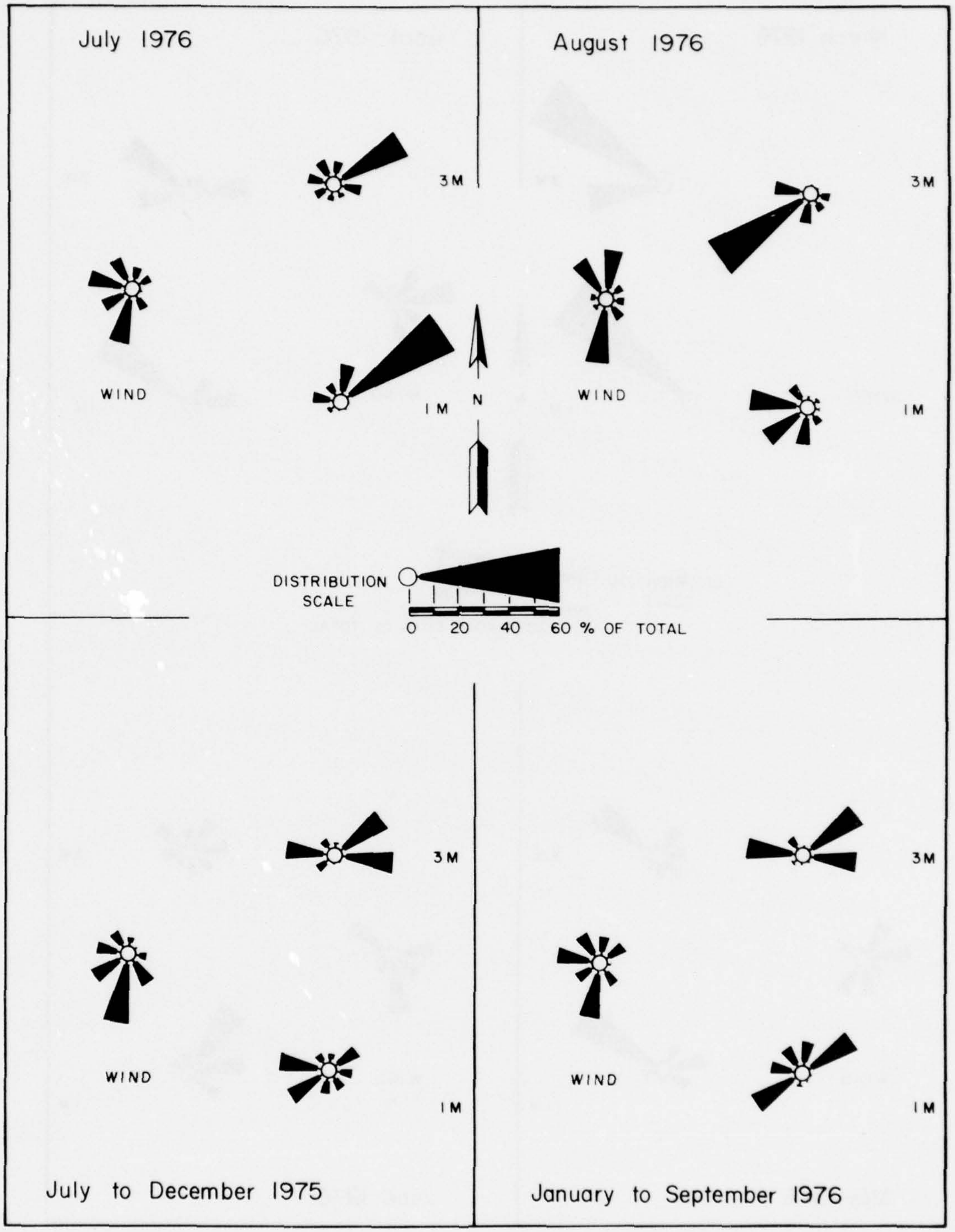

Figure F'4. Monthly and yearly current roses and wind roses

APPENDIX G': VERTICAL PROFILE TABLES FOR CURRENTS, TEMPERATURE, AND TRANSMISSIVITY

Table G'1

Vertical Profiles of Temperature, Current Speed, and Current Direction

Measured at locations TC3, TC4, and TC5 on 10 July 1975

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC1				TC2				TC3				TC4				TC5				TC6				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0									23.9				24.2				24.4				24.0		19	090				
0.5									-				-				-				-							
1									23.9		13	092	24.2		13	063	24.4		24	078	24.0							
2									23.9				24.2				24.4				24.0							
3									23.9				24.2				24.3				24.0							
4									23.9				24.2				24.3				24.0							
5									23.9				24.2				24.3				24.0							
6									23.9				24.2				24.3				24.0							
7									23.9				24.2				24.3				24.0							
8									23.9				24.2				24.3				24.0							
9									23.9		4	234	24.1		12	179	24.2				23.9							
10									23.7				24.1				24.2		10	023	23.9							
10.5									-				-				-				-							
11									18.3				24.0				24.1				23.9							
11.5									-				-				-				-							
12									17.4		18	225	19.0				18.8				23.9							
13									16.5				17.4		5	313	17.0				23.9							
14									13.6				16.8						3	031	23.9							
14.5									-												-							
15									12.5												23.9		21	107				
15.5									-												23.9							
16									12.0						8	010			5	197	23.9							
16.5																					-							
17																					23.9		21	102				
17.5																					23.9							
18											11	012			8	039					23.9							
18.5																					-							
19																							22	056				
19.5																												
20											6	024																
Total Depth										21.0m				19.0m				17.8m				13.0m						
Time (EDT)										0940-1022				1048-1112				1130-1200				0811-0823						

Table G'2

Vertical Profiles of Temperature, Transmissivity, Current Speed, and Current Direction Measured at locations TC1, TC2, and PC1 on 11 July 1975

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC1				TC2				TC3				TC4				TC5				TC6				PC1			
Depth (m)	°C	%	cm/ sec	°T	°C	%	cm/ sec	°T	°C	%	cm/ sec	°T	°C	%	cm/ sec	°T	°C	%	cm/ sec	°T	°C	%	cm/ sec	°T	°C	%	cm/ sec	°T
0	24.0		17	082	23.6		21	086																	24.3			
0.5	-				-																				-			
1	24.0				23.6																				24.3		27	066
2	24.0				23.7																				24.3			
3	24.0				23.7																				24.3			
4	24.0				23.6																				24.3			
5	24.0				23.7																				24.3		16	144
6	24.0				23.7																				24.2			
7	24.0				23.7																				24.2			
8	24.0				23.7																				24.1			
9	23.9				23.7																				24.1			
10	21.3				23.7																				24.1		9	350
10.5	-		17	095	-																				-			
11	18.2				23.6																				24.0			
11.5	-				-		15	051																	-			
12	17.2				23.7																				19.8		8	024
13					17.7																				17.1			
14																												
14.5							21	090																				
15																												
15.5			7	142																								
16																												
16.5							3	350																				
17																												
17.5			8	233																								
18																												
18.5							10	334																				
19																												
19.5			3	225																								
20																												
Total Depth	20.5m				19.5m																				16.5m			
Time (EDT)	0944-1006				0859-0917																				1206-1220			

Table G'3

Vertical Profiles of Temperature, Transmissivity, Current Speed and Current Direction Measured at locations TC1-TC6, and PC1, on 1 August 1975

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC1				TC2				TC3				TC4				TC5				TC6				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0	26.6	21.0			26.8	19.0			26.3	22.0			26.7	22.0			25.8	21.0			27.1	14.0			27.0	19.0		
0.5	-				-	-			-	-			-	-			-	-										
1	25.9	21.0	11	190	26.0	18.0	14	217	25.9	21.0	11	204	25.7	21.0	11	195	25.4	20.0	14	182	27.1	13.0	15	226	25.8	17.0	14	197
2	25.1	19.0			25.4	18.0			25.1	20.0			25.3	20.0			-	-										
3	-	-			-	-			-	-			-	-			25.2	19.0										
4	24.9	19.0			25.0	17.0			24.9	19.0			25.1	19.0			-	-										
5	-	-			-	-			-	-			-	-			24.9	18.0										
6	24.3	18.0			24.5	13.0			24.2	18.0			24.5	17.0			-	-			27.1	15.0	1	225				
7	-	-			-	-			-	-			-	-			24.9	17.0										
8	23.9	17.0			24.0	15.0			23.9	17.0			24.0	17.0	2	208	-	-	4	264								
8.5	-	-			-	-	5	257	-	-			-	-			-	-							23.8	16.0	5	246
9	-	-			-	-			-	-			-	-			24.0	18.0			27.1	1.1	3	174				
9.5	-	-	6	200	-	-			-	-	7	189	-	-			-	-										
10	23.6	17.0			23.6	16.0			23.6	19.0			23.6	16.0			-	-										
11	-	-			-	-			-	-			-	-			23.6	20.0			23.6	0.2	1	038				
12	23.5	19.0			23.5	17.0			23.5	20.0			23.5	18.0			-	-										
13	-	-			-	-			-	-			23.2	19.0			23.7	21.0	3	244								
14	23.3	20.0			23.3	18.0	3	255	23.3	21.0			23.3	19.0			23.4	21.0							23.2	16.0	1	190
14.5	-	-			-	-			-	-			-	-	4	309	-	-										
15	23.2	19.0			22.4	11.0			23.2	20.0			23.1	19.0			22.6	16.0	3	253					22.7	9.0		
15.5	-	-			-	-			-	-			-	-			-	-										
16	17.5	16.0	<.01	294	11.0	6.0	3	065	22.4	20.0			14.5	12.0			15.0	7.0							11.4	7.0	2	190
16.5	-	-			-	-			-	-	1	115	-	-	2	358												
17	10.0	7.0			10.8	7.0			11.8	17.0			11.4	6.0														
17.5	-	-							-	-			11.2	-														
18	10.0	6.0	1	120					9.8	8.5																		
18.5	10.0	6.0							-	-	2	011																
19									9.7	8.0																		
19.5									9.6	0.0																		
20																												
Total Depth	19.0m				17.0m				19.5m				17.5m				16.0m				12.0m				17.0m			
Time (EDT)	1540-1616				1625-1700				1535-1550				1410-1425				1215-1331				1720-1738				1655-1720			

Table C'4

Vertical Profiles of Temperature, Current Speed, and Current Direction Measured at locations TC4 and TC5 during Disposal Operation on 5 August 1975

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC1				TC2				TC3				TC4				TC5				TC6				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0													25.5				25.4											
1													25.5		3	069	25.4		3	191								
2													25.5				25.4											
3													25.5				25.4											
4													25.5				25.4											
5													25.5				25.4											
6													25.5				25.4											
7													25.5				25.4											
8													25.5				25.4		7	263								
9													25.5		4	109	25.4											
10													25.5				25.4		5	254								
11													25.5				25.4											
12													25.3				25.4											
12.5													-		10	175												
13													25.3				25.4											
13.5													-						16	207								
14													25.3				24.6											
15													15.5				15.2											
15.5													-		4	232	14.2		5	313								
16													11.5															
16.5													-															
17													11.2															
17.5															11	214												
Total Depth													17.5m				15.5m											
Time (EDT)													1138-1158				1325-1344											

Table G'5

Vertical Profiles of Temperature, Current Speed, and Current Direction Measured at locations TC4, TC5, and C1 (Control Site 1) on 8 August 1975

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC1				TC2				TC3				TC4				TC5				TC6				C1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0													22.9				24.2	26.0							23.8	66.0		
1													22.9		28	230	-	36.0	23	232					23.9	68.0		
2													22.9				24.1	30.0							23.9	64.0		
3													22.9				-	26.0							23.9	-		
4													22.9				23.8	35.0							23.6	42.0		
5													22.9				-	27.0							23.5	-		
6													22.9				23.5	24.0							23.4	43.0		
7													22.9				-	35.0							23.4	-		
8													22.9		23	227	23.3	38.0	29	231					23.3	49.0		
9													22.9				-	46.0							23.1	-		
10													22.9				23.0	48.0	27	232					23.1	38.0		
11													22.7				-	18.0							23.1	-		
12													22.5		25	223	18.3	0.0	19	230					20.8	5.2		
13													16.4				11.8	0.0							19.5	-		
14													10.9		20	235	11.4	0.0	1	137					14.8	5.8		
15													10.4				11.1	0.0							12.7	-		
16													10.2		6	036									10.2	6.2		
17													10.1												10.1	5.0		
17.5																										5.6		
18																										0		
Total Depth													17.0m				15.5m								19.0m			
Time (EDT)													0630-0753				1420-1500								1530-1540			

Table G'6

Vertical Profiles of Temperature, Transmissivity, Current Speed, and Current Direction Measured at locations TC1-TC6, and PC1, on 14 August 1976

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC1				TC2				TC3				TC4				TC5				TC6				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0	23.1	35.0			22.6	31.0			22.3	39.0			23.6	28.0			23.5	26.0			23.5	16.0			23.2	24.0		
0.5	-	-			-	-			-	-			-	-			-	-			-	-			-	-		
1	-	-	19	241	-	-	4	229	-	-	17	227	-	-	1	357	-	-	1	264	-	-	18	039	-	-	4	076
2	-	-			-	-			-	-			-	-			-	-			-	-			-	-		
3	23.0	35.0			22.6	31.0			22.8	37.0			23.1	26.0			23.1	26.0			23.5	16.0			23.1	22.0		
4	22.9	35.0			-	-			-	-			-	-			-	-			-	-			-	-		
5	-	-			-	-			-	-			-	-			-	-			-	-			-	-		
6	22.7	31.0			22.6	30.0			22.7	37.0			22.9	24.0			22.9	26.0			23.5	3.0	16	043	22.9	21.0		
7	-	-			-	-			-	-			-	-			-	-			-	-			-	-		
8	-	-			-	-	11	059	-	-			-	-	4	231	-	-	11	045	-	-			-	-		
8.5	-	-			-	-			-	-			-	-			-	-			-	-			-	-	2	233
9	22.7	32.0	9	229	22.6	30.0			22.6	36.0			22.8	26.0			22.9	26.0			23.5	0.2	18	047	22.8	22.0		
10	-	-			-	-			-	-	5	215	-	-			-	-			-	-			-	-		
11	-	-			-	-			-	-			-	-			-	-			-	-	19	030	-	-		
12	22.7	33.0			22.5	30:0			22.5	37.0			22.7	30.0			22.6	23.0			23.5	0.0			22.8	24.0		
12.5	-	-			-	-			-	-			-	-			-	-	4	088					-	-		
13	22.7	34.0			22.5	30.0			22.4	38.0			22.6	32.0			22.3	23.0							22.7	25.0		
13.5	-	-			-	-			-	-			-	-	9	161	-	-							-	-		
14	22.7	29.0	8	201	22.1	21.0	11	103	22.2	38.0			15.5	27.0			17.1	11.0							15.3	10.0	11	187
14.5	-	-			-	-			-	-			-	-			18.5	3.0	12	205					-	-		
15	17.3	10.0			17.5	14.0			19.0	36.0			11.1	1.7			15.5	6.4							11.8	3.0		
15.5	-	-			-	-			-	-			-	-			11.6	0.0							-	-		
16	12.3	12.0			10.3	20.9	8	076	12.1	25.0			10.7	1.5											11.1	2.4	14	243
16.5	-	-			-	-			-	-			-	-	5	096									-	-		
17	10.5	8.2	8	142	10.1	18.0			9.9	23.0	7	189	10.6	0.0											10.9	2.9		
18	9.9	7.8							9.8	22.0																		
19									9.8	21.0	8	221																
20									9.8	0.0																		
Total Depth	18.0m				17.0m				20.0m				17.5m				15.5m				12.5m				17.0m			
Time (EDT)	1155-1215				1055-1120				1410-1440				1337-1355				1305-1322				0950-1015				1230-1250			

Table G'7

Vertical Profiles of Temperature, Transmissivity, Current Speed, and Current Direction Measured at locations TC1-TC6, and PC1 on 14 September 1975

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC1				TC2				TC3				TC4				TC5				TC6				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0	20.4	10.0			20.5	9.0			20.2	10.0			20.1	8.5			20.0	8.0			19.1	0.9			20.5	10.0		
1	20.4	10.0	6	095	20.5	9.2	11	107	20.2	10.0	17	316	20.1	8.4	4	176	20.0	8.0	11	79	19.1	0.8			20.5	10.0	12	093
2	20.4	10.0			20.5	9.0			20.2	10.0			20.1	8.4			20.0	7.8			19.1	0.8			20.5	10.0		
3	20.3	9.0			-	-			-	-			-	-			-	-			-	-			-	-		
4	20.3	9.0			20.2	8.1			20.1	9.0			20.1	8.2			20.0	7.7			19.1	0.6			20.2	9.7		
5	-	-			-	-			-	-			-	-			-	-			-	-			-	-		
6	20.2	8.8			20.1	8.1			20.1	9.0			20.1	7.9			20.0	7.4			18.9	0.4			20.1	8.3		
7	-	-			-	-			-	-			-	-			-	-			-	-			-	-		
7.5	-	-			-	-			-	-			-	-			-	-	8	178	-	-			-	-		
8	20.2	8.8			20.1	8.0			20.1	9.2			20.1	8.0			20.0	6.4			18.6	0.3			20.0	7.7		
8.5	-	-			-	-	15	059	-	-			-	-	5	019	-	-			-	-			-	-	6	067
9	-	-			-	-			-	-			-	-			-	-			-	-			-	-		
9.5	-	-	6	042	-	-			-	-			-	-			-	-			-	-			-	-		
10	20.2	8.9			20.1	7.1			20.1	9.2	26	315	20.1	8.1			19.9	4.2			18.3	0.0			20.0	6.0		
11	-	-			-	-			-	-			-	-			19.9	2.0			-	-			19.9	2.5		
12	20.2	8.8			20.0	5.1			20.1	9.0			20.1	7.7			19.6	0.6	6	199	17.5	0.0			19.7	0.6		
13	-	-			-	-			-	-			-	-			19.2	0.2							-	-		
14	20.2	8.8			19.9	3.5	18	049	20.1	8.7			20.1	7.8	24	040	19.1	0.2	27	042					18.8	0.2	7	013
15	-	-			19.6	0.6			-	-			20.1	7.7			19.1	0.2							18.8	0.2		
15.5	-	-			-	-			-	-			-	-											-	-		
16	20.2	8.8	10	049	19.3	0.4	18	044	20.0	8.7	20	231	20.1	6.9	9	205									18.8	0.2	6	359
16.5	-	-			-	-			-	-			-	-											-	-		
17	-	-			19.3	0.4			20.0	9.2			20.1	4.0											18.8	0.2		
17.5	-	-							-	-																		
18	20.1	9.2	13	042					20.0	9.3	8	343																
18.5	-	-							-	-																		
19	19.8	0.0							20.0	7.6																		
19.5									-	-																		
20									-	6.2																		
Total Depth	19.0m				17.0m				20.0m				17.0m				15.0m				12.0m				17.0m			
Time (EDT)	1320-1350				1410-1422				1230-1255				1110-1135				0920-1000				0750-0800				1450-1510			

Table G'8

Vertical Profiles of Temperature, Transmissivity, Current Speed and Current Direction Measured at locations TC3, TC4, and TC5 on 17 October 1975

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC1				TC2				TC3				TC4				TC5				TC6				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0									15.3	12.0				11.0			15.4	9.8										
0.5									-	-							-	-										
1									15.3	13.0	25	220		11.0	16	204	15.4	9.8	13	217								
2									15.3	12.0				11.0			15.4	9.8										
3									-	-							-	-										
4									15.3	12.0				11.0			15.4	10.0										
5																	-	-										
6																	15.4	10.0										
7																	-	-										
7.5																	-	-										
8										13.0				11.0			15.4	10.0	16	071								
8.5															4	000	-	-										
9																	-	-										
10											25	210					15.4	10.0										
11																	-	-										
12																	15.4	10.0										
13.5																	-	-	16	72								
14																	15.4	10.0										
14.5															4	111												
15																	-	-										
15.5																	-	-	12	123								
16										13.0				11.0			15.4	10.0										
16.5															8	115	-	10.0										
17											9	233		11.0														
17.5																												
18										13.0																		
18.5																												
19										13.0																		
19.5																												
20																												
Total Depth										20.0m																		
Time (EDT)									1100-1120				0940-1010				0855-915											

Table G'9

Vertical Profiles of Temperature, Transmissivity, Current Speed and Current Direction Measured at locations TC1-TC6, and PC1 on 16 November 1975

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC1				TC2				TC3				TC4				TC5				TC6				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0	11.4	0.0			11.1	0.0			11.4	0.2			11.3	0.2			11.0	0.3			10.4	0.5			11.1	0.1		
0.5	-	-			-	-	14	206	-	-	4	337	-	-	5	221	-	-	4	235	-	-	33	050	-	0.1	11	215
1	11.4	0.0	33	222	11.1	0.0	15	211	11.4	0.0	4	242	11.3	0.0	7	208	10.9	0.0	13	212	10.3	0.0	33	057	11.1	0.0	13	211
2	11.4	0.0			11.0	0.0			11.3	0.0			11.3	0.0			10.8	0.0			10.2	0.0			11.1	0.0		
3	11.4	0.0			10.8	0.0			11.3	0.0			-	-			10.7	0.0			10.1	0.0			11.1	0.0		
4	11.3	0.0			10.8	0.0			11.2	0.0			11.0	0.0			10.7	0.0			10.1	0.0			10.8	0.0		
5	11.2	0.0			10.8	0.0			11.2	0.0			11.0	0.0			10.7	0.0			10.1	0.0			10.7	0.0		
6	11.0	0.0			10.8	0.0			11.2	0.0			11.0	0.0			10.7	0.0			10.1	0.0			10.7	0.0		
7	11.0	0.0			10.8	0.0			11.2	0.0			11.0	0.0			10.7	0.0			10.1	0.0			10.7	0.0		
7.5	-	-			-	-			-	-			-	-			-	-	8	319	-	-	33	038	-	-	11	236
8	11.0	0.0			10.8	0.0	11	223	11.2	0.0			11.0	0.0			10.7	0.0			10.1	0.0			10.7	0.0		
8.5	-	-			-	-			-	-	8	226	-	-			-	-			-	-	28	034	-	-		
9	11.0	0.0	13	225	10.8	0.0			11.2	0.0			11.0	0.0			10.7	0.0			10.1	0.0			10.7	0.0		
10	11.0	0.0			10.8	0.0			11.2	0.0			11.0	0.0	10	353	10.7	0.0			10.0	0.0			10.7	0.0		
11	11.0	0.0			10.8	0.0			11.2	0.0			11.0	0.0			10.7	0.0			10.0	0.0	23	028	10.7	0.0		
12	11.0	0.0			10.8	0.0			11.2	0.0			11.0	0.0			10.7	0.0	15	034	10.1	0.0			10.7	0.0		
13	11.0	0.0			10.8	0.0	8	223	11.2	0.0			11.0	0.0			10.7	0.0							10.7	0.0	11	238
14	11.0	0.0	14	233	10.8	0.0			11.2	0.0			11.0	0.0	10	219	10.7	0.0							10.7			
15	11.0	0.0			10.8	0.0	7	221	11.2	0.0			11.0	0.0			10.7	0.0	14	222					10.7	0.0	12	238
16	11.0	0.0			10.8	0.0			11.2	0.0	11	226	11.0	0.0	5	245									10.7	0.0		
16.5	-	-							-	-															10.7	0.0		
17	11.0	0.0	8	241					11.2	0.0																		
17.5	-	-							-	-																		
18	11.0	0.0							11.2	0.0																		
18.5									-	-																		
19									11.2	0.0																		
19.5																												
20																												
Total Depth	18m				16.5m				19.0m				16.7m				15.2m				12.0m				16.5m			
Time (EST)	1705-1730				1630-1645				1520-1542				1440-1510				1330-1339				1214-1230				1600-1621			

Table G'10

Vertical Profiles of Temperature, Transmissivity, Current Speed and Current Direction Measured at locations TC2, TC4, TC5, ND and PC1 on 28 March 1976

Temperature (°C), transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC2				TC4				TC5				D3				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0	3.81	0.35			3.8	0.15			3.9	1.20			3.6	0.25			4.0	0.22		
1	3.81	0.17	* 2.4 / 2.6	180 / 219	3.8	0.08	1.3 / 1.9	089 / 054	3.9	0.18	4.2	075	3.6	0.14	2.1 / 2.2	052 / 048	4.0	0.07	1.8	073
2	3.80	0.17			3.7	0.01			3.9	0.01			3.6	0.07			4.0	0.05		
3	-	-			-	-			-	-			-	-			-	-		
4	3.80	0.04			3.7	0.0			3.8	0.01			3.6	0.04			4.0	0.0		
5	-	-			-	-			-	-			-	-			-	-		
6	3.69	0.03			3.7	0.0			3.9	0.01			3.5	0.03			3.9	0.0		
7	-	-			-	-			-	-			-	-			-	-		
8	3.61	0.02			3.8	0.0			3.8	0.01	5.6 / 6.1	059 / 058	3.5	0.02			3.9	0.0	4.5	282
8.5	-	-	4.5 / 5.9	252 / 067	-	-			-	-			-	-			-	-	0.6	035
9	-	-			-	-	2.1	056	-	-			-	-	2.4	030	-	-		
10	3.62	0.02			3.8	0.0			3.8	0.01			3.5	0.02			3.9	0.0		
11	-	-			-	-			-	-			-	-			-	-		
12	3.61	0.02			3.8	0.0			3.9	0.01			3.5	0.02			3.9	0.0		
13	3.61	0.03			3.8	0.0			3.9	0.01	5.6 / 2.9	054 / 257	3.5	0.02			3.9	0.0		
14	3.60	0.03			3.8	0.0			3.9	0.01			3.5	0.02			3.9	0.0		
15	3.50	0.03	1.6 / 5.6	026 / 273	3.8	0.0			3.9	0.01	4.6 / 4.6	051 / 053	3.5	0.02			3.8	0.0	0.9 / 2.3	296 / 310
15.5	-	-			-	-			-	-			-	-	2.1 / 1.8	035 / 000	-	-		
16	3.60	0.02			3.8	0.0			3.9	0.0			3.5	0.02			3.8	0.0		
16.5	-	-			-	-							-	-			-	-		
17	3.60	0.02	5.3 / 0.3	068 / 007	3.8	0.0	2.0 / 2.4	030 / 035					3.5	0.02			3.8	0.0		
17.5	3.60	-			3.8	0.0							-	-	2.0 / 1.5	033 / 001	3.8	-	4.7	069
18													3.5	0.02						
18.5													3.5	0.02						
19																				
Total Depth	17.6m				17.8m				16.2m				18.5m				17.5m			
Time (EST)	1350-1430				1710				1215-1223				1550-1621				1455-1530			

* Two sets of data obtained at the same depth within 6 minutes

Table G'11

Vertical Profiles of Temperature, Transmissivity, Current Speed and Current Direction Measured at locations TC2, TC4, TC5, ND and PC1 on 21 April 1976

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC2				TC4				TC5				D3				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0	10.53	1.8			9.81	2.6			10.12	2.0			9.84	3.1			10.44	1.7		
1	10.44	1.8	2.1	233	9.75	2.8	3.3	223	10.08	2.0	1.0	178	9.78	2.6	2.6	005	10.39	1.8	4.6	206
2	10.12	2.3			9.55	3.3			10.01	1.9			9.74	2.6			10.18	2.2		
4	9.42	3.1			9.22	3.8			9.89	2.1			9.30	3.5			9.76	2.7		
6	8.86	3.2			8.48	4.8			9.50	2.2			8.62	4.3			9.16	3.4		
8	7.60	4.4	11.3	121	7.63	5.8	2.6	279	8.23	2.2	2.9	233	7.64	5.5			7.56	4.6	10.8	121
10	6.71	4.2			6.88	7.8			6.95	4.1			7.19	7.0	0.6	263	5.76	8.3		
12	6.48	4.1			5.66	12.0			5.44	8.5			6.59	9.4			5.60	9.6		
13	-				-	-			-	-	2.9	253	-	-			-	-	11.2	328
14	5.81	6.2	7.1	277	5.29	14.0	1.1	276	5.42	8.8			5.40	11.0			5.60	9.6		
15	5.42	9.3			-	-			5.41	8.7	2.6	291	-	-	2.3	220	5.59	9.5	5.8	328
15.5	-				-	-			-	-			-	-			-	-		
16	5.30	9.4	6.5	083	5.24	14.0	2.7	211	5.40	8.7			5.29	10.0			5.59	8.8		
16.5	-				-	-							-	-						
17	5.36	9.4			5.23	14.0							5.28	10.0	1.8	239				
17.5													-	-						
18													5.27	10.0						
18.5																				
19																				
Total Depth	17.8m				17.0m				16.0m				18.0m				16.0m			
Time (EST)	1700-1730				1527-1547				1357-1500				1606-1638				1750-1808			

Table G'12

Vertical Profiles of Temperature, Transmissivity, Current Speed and Current Direction Measured on locations TC4, TC5, ND and PC1 on 13 May 1976

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC4				TC5				TC5				D3				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0	11.44	1.60			10.65				12.00	3.0			11.14	1.50			11.20	0.50		
1	11.40	0.80	8.9	235	10.65		21.4	146	12.00	0.71	9.8	273	11.13	0.80	27.1	270	11.19	0.27	20.9	265
2	11.40	0.37			10.65				11.80	0.25			11.13	0.44			11.14	0.18		
4	11.01	0.23			10.65				11.40	0.14			11.00	0.39			11.10	0.15		
6	10.62	0.25			10.65				10.86	0.13	1.9	261	10.85	0.37			11.07	0.15		
8	10.55	0.30			10.65				10.86	0.12			10.51	0.39			10.85	0.15	5.2	312
10	10.57	0.31	1.9	174	10.65				10.86	0.11			10.50	0.36	8.3	155	10.72	0.14		
12	10.46	0.36			10.63		21.5	167	10.86	0.11	4.6	248	10.42	0.34			10.69	0.13		
13	-	-			-				-	-			-	-			-	-		
14	10.43	0.40			10.65				10.86	0.11			10.43	0.34			10.67	0.13		
15	-	-	7.1	292	10.65				10.86	0.11	2.9	014	10.44	0.34			10.68	0.13	6.7	280
15.5	-	-			-		36.7	176	-	-			-	-			-	-		
16	10.40	0.43			10.63				10.85	0.10			10.44	0.36			10.67	0.13		
16.5	-	-			-								-	-			-	-	3.4	204
17	10.30	0.44	5.3	283									10.26	0.48	3.3	191	10.66	0.13		
17.5	10.27	0.41											-	-			10.65	0.09		
18	10.26	0.40											10.24	0.46						
18.5													-	-						
19													10.24	0.46	3.7	178				
Total Depth	18.0m				16.0m				16.0m				19.0m				17.5m			
Time (EDT)	1720-1735				0819-0835				1626-1640				1806-1820				1853-1910			

Table G'13

Background Data of Transmissivity Measured at Location ND during Disposal Operation on 25 May 1976

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	D3				D3				D3											
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0		2.00				2.20				3.20										
1		1.40				1.20				1.95										
2		1.20				1.30				1.15										
4		1.10				0.52				1.40										
6		0.90				0.22				1.10										
8		1.20				1.80				1.80										
10		1.70				1.80				2.05										
12		3.40				2.00				1.90										
14		4.40				2.00				4.40										
15		-				-				4.60										
16		2.50				4.20				4.20										
17		0.00				2.20				2.30										
18		0.00				0.00				0.00										
Total Depth		18.0m				18.0m				18.0 m										
Time (EDT)		1115				1134				1145										

Table G'14

Vertical Profiles of Temperature, Transmissivity, Current Speed and Current Direction Measured at locations TC2, TC4, TC5, ND, and PC1 on 7 June 1976

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC2				TC4				TC5				ND(D3)				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0	14.70	8.0			14.68	10.0			14.32	8.0			14.88	8.0			14.56	9.0		
1	14.67	8.1	3.9	278	14.63	10.0	29.9	086	14.24	8.0	12.5	018	14.85	8.0	20.4	202	14.56	9.0	4.9	342
2	14.62	7.8			14.61	10.0			14.08	8.0			14.71	8.0			14.50	9.0		
4	14.19	7.3			14.37	9.0			13.96	8.0			14.59	8.0			14.32	8.0		
6	13.50	6.8			13.54	9.0			12.06	8.0			13.96	7.0			13.51	8.0		
7	11.80	7.0			-	-			-	-	14.1	234	-	-			-	-		
8	10.77	7.3	10.7	017	12.88	9.0	24.1	140	11.26	8.0			13.67	8.0	25.4	236	11.92	8.0	4.3	218
10	10.08	7.2			11.62	9.0			9.81	9.0			12.77	8.0			10.64	8.0		
12	9.64	8.2	10.4	259	10.62	11.0	20.3	225	9.02	10.0	10.7	182	11.17	8.0			9.32	9.0		
14	9.46	9.2			9.11	12.0			8.96	10.0			9.34	10.0	25.4	088	9.14	9.2	4.1	296
15	-	-			-	-			8.95	9.0	7.6	261	-	-			-	-		
15.5	-	-			-	-			8.95	9.0			-	-			-	-		
16	9.31	9.4	5.8	167	9.06	12.0	7.1	316	8.95	9.0			9.05	9.0			8.98	8.8	4.9	224
16.5	-	-			9.05	11.0			-	-			-	-			8.93	8.6		
17	9.17	8.7			9.11	11.0							9.04	9.0	24.6	113	8.91	8.6		
17.5	9.18	8.3			9.11	12.0							-	-			8.95	8.5		
18	9.20	7.6			9.11	12.0							9.04	9.0						
18.5													9.07	9.0						
19													9.04	0.0						
Total Depth	18.0m				18.0m				16.0m				19.0m				17.0m			
Time (EDT)	1405-1430				1127-1145				1222-1240				1106-1120				1313-1335			

Table G'15

Vertical Profiles of Temperature, Transmissivity, Current Speed and Current Direction Measured at locations TC2, TC4, TC5, ND and PC1 on 9 July 1976

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC2				TC4				TC5				D3				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0	22.65	12.2			22.42	13.0			22.56	12.0			22.34	15.0			21.66	14.0		
1	22.43	12.1	3.6	275	22.40	13.0	2.6	262	22.50	11.0	2.1	253	22.29	14.0	2.7	268	21.62	14.0	1.5	243
2	21.98	12.0			22.20	13.0			22.36	11.0			21.76	14.0			21.47	14.0		
3	-	-			-	-			-	-			-	-			-	-		
4	20.96	12.1			21.02	13.0			21.50	11.0			20.82	14.0			21.03	14.0		
5	-	-			-	-			-	-			-	-			-	-		
6	20.78	12.2			20.69	13.0			20.90	11.1			20.65	14.1			20.82	13.0		
7	-	-			-	-			-	-			-	-			-	-		
8	20.65	12.5	2.7	187	20.55	14.0	2.5	201	20.73	11.9	1.0	202	20.53	15.1			20.80	13.0		
9	-	-			-	-			-	-			-	-	2.6	214	-	-	1.0	194
10	20.56	13.5			20.50	14.0			20.67	11.8			20.42	15.9			20.75	15.0		
11	-	-			-	-			-	-			-	-			-	-		
12	20.48	14.0			20.42	14.0			20.28	12.0			20.29	15.5			20.68	16.0		
13	-	-			-	-			-	-	3.6	245	-	-			-	-	4.6	268
14	19.17	9.0	1.0	253	20.12	14.0	1.0	190	19.00	11.9			20.17	15.3			19.28	11.0		
15	18.69	7.0			-	-			18.98	7.0	2.1	208	-	-	0.4	280	18.99	7.0		
15.5	-	-			-	-			18.98	6.0			-	-			-	-	1.6	281
16	18.62	6.0	1.9	231	18.56	6.0	1.1	183	18.97	6.0			18.69	12.0			18.81	6.0		
16.5	18.59	5.7			18.54	6.0							-	-			18.85	5.0		
17	18.20	0.0			18.55	6.0							18.65	8.5	0.7	210				
17.5													18.63	8.0						
18													18.61	0.0						
18.5																				
Total Depth	18.0m				17.0m				16.0m				18.0m				16.5m			
Time (EDT)	1735-1756				1622-1642				1550-1559				1656-1717				1530-1540			

Table G'16

Vertical Profiles of Temperature, Transmissivity, Current Speed and Current Direction Measured at locations TC2, TC4, TC5, ND, and PC1 on 9 September 1976

Temperature (°C), Transmissivity (%), Current Speed (cm/sec), Current Direction (°T)

Location	TC2				TC4				TC5				N.D. (D3)				PC1			
Depth (m)	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T	°C	%	cm/sec	°T
0	21.21	10.0			21.15	15.0			21.39	11.0			21.77	12.0			21.78	5.0		
1	21.16	10.0	30.6	232	21.00	10.0	4.7	166	20.93	10.0	4.4	121	21.49	12.0	4.2	167	21.01	7.9	4.2	135
2	20.67	8.2			20.77	10.0			20.62	9.0			20.72	12.0			20.68	7.4		
4	20.36	8.0			20.40	10.0			20.39	8.0			20.45	10.0			20.39	6.6		
6	20.29	9.2			20.20	10.0			20.32	8.7			20.26	10.0			20.31	7.0		
8	20.25	10.5	2.1	155	20.14	12.0	1.0	251	20.29	10.0	1.2	265	20.19	12.0	2.2	268	20.25	7.4	1.5	303
10	20.24	12.0			20.11	12.0			20.26	15.0			20.17	12.0			20.26	7.7		
12	20.24	12.0			20.10	12.0			20.26	15.0	2.8	304	20.14	12.5			20.25	7.9	4.0	002
14	20.11	10.0	2.2	314	20.10	12.0	0.9	260	20.24	15.0			20.14	10.0			20.23	8.3		
15	16.58	8.0			20.01	12.0			16.78	3.0	2.5	300	-		2.2	280	18.59	7.0		
15.5	-	-			-	-			15.75	2.4			-				16.2	5.6	7.6	303
16	16.44	5.2	0.3	097	18.11	10.0			15.34	0.0			17.07	10.0			16.06	2.0		
16.5	16.19	4.8			15.16	5.5	1.1	041					-							
17	16.22	0.0			15.02	5.4							15.59	7.6	2.1	053				
17.5					14.92	2.0							-							
18													15.07	0.0						
18.5																				
19																				
Total Depth	17.0m				17.6m				16.2m				18.0m				16.5m			
Time (EDT)	1600-1615				1500-1515				1425-1435				1530-1540				1320-1330			

APPENDIX H': VERTICAL PROFILE PLOTS OF OVER-THE-SIDE CURRENT-METER DATA

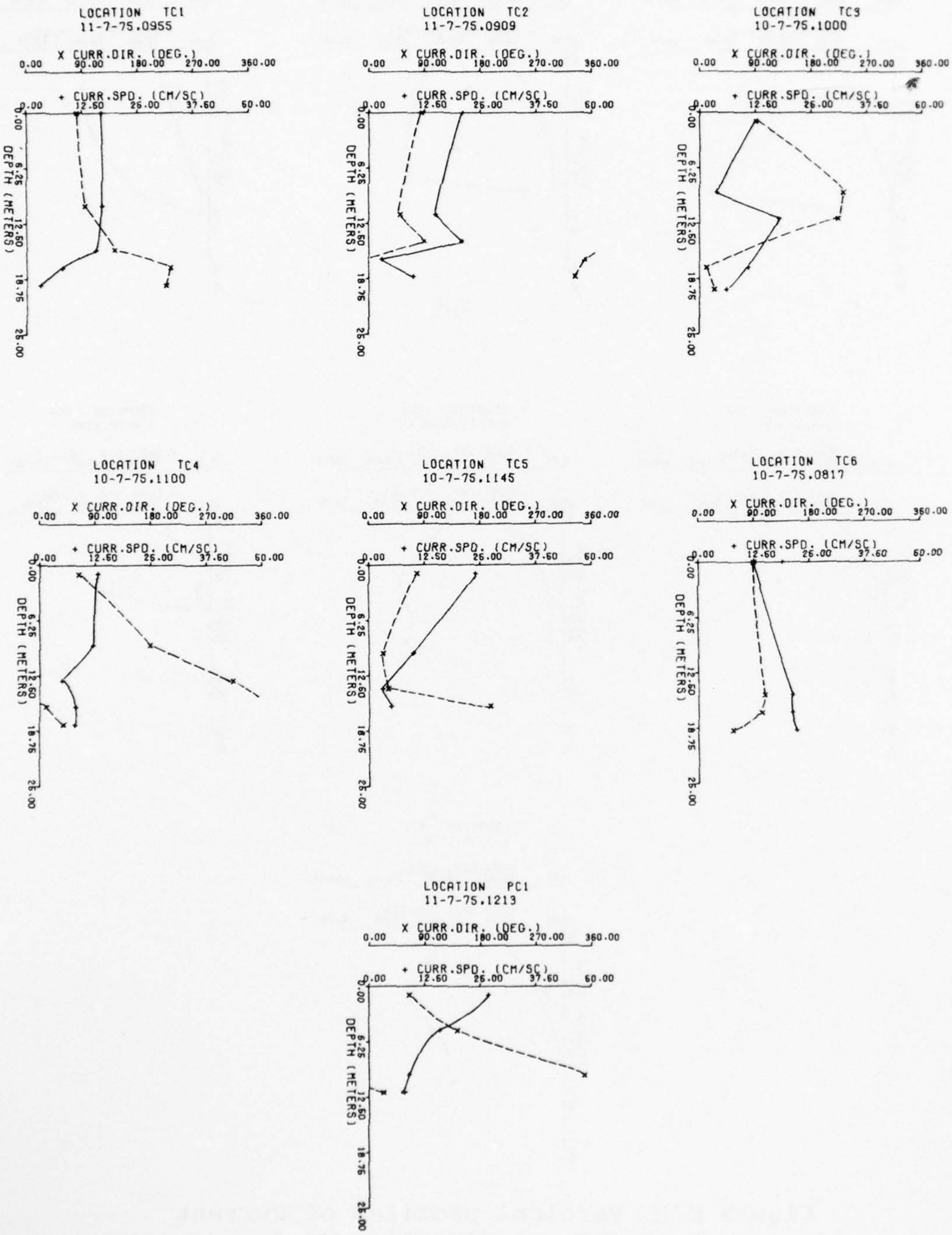

Figure H'1. Vertical profiles of current speed and direction, 10 July 1975

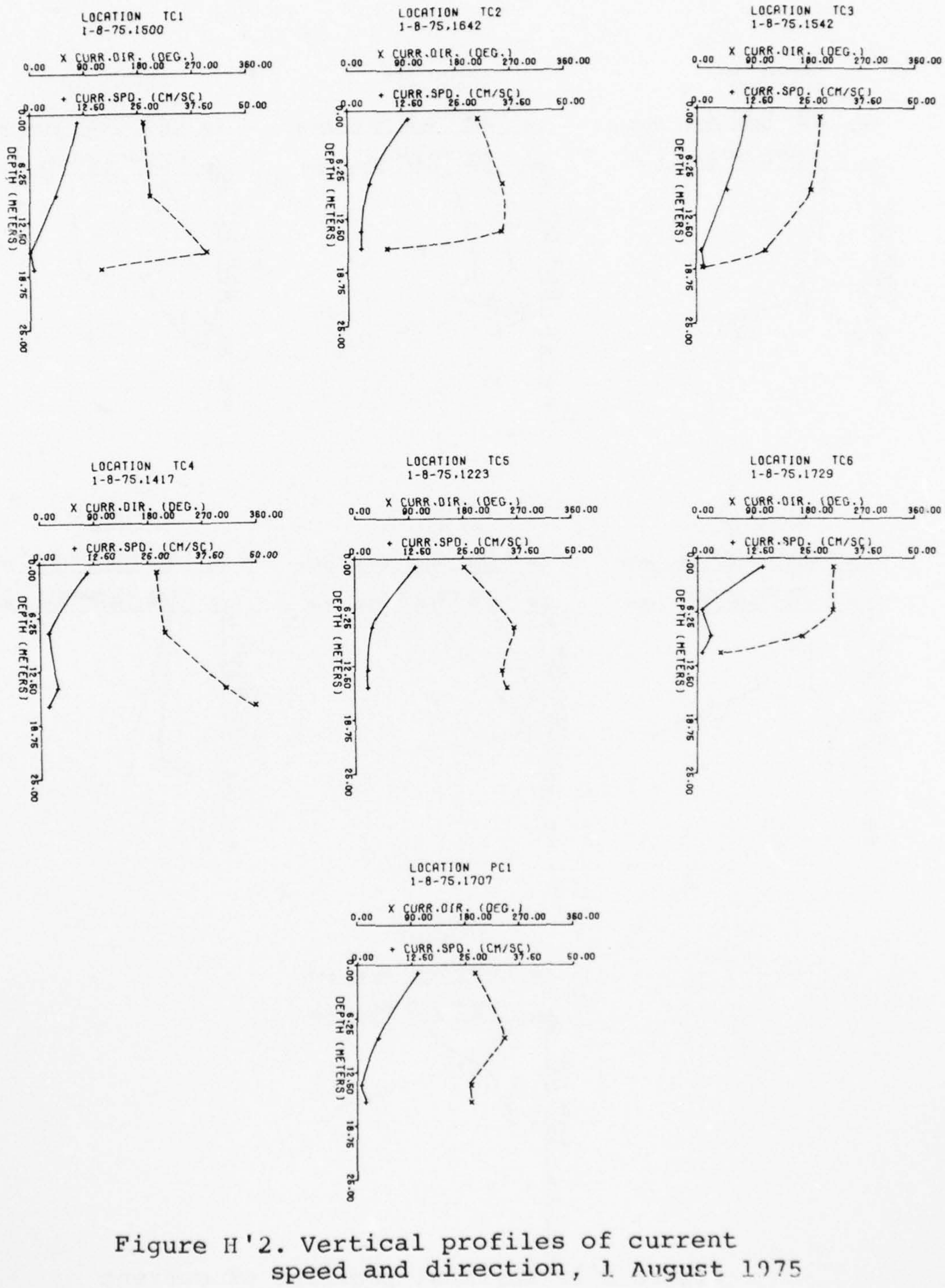

Figure H'2. Vertical profiles of current speed and direction, 1 August 1975

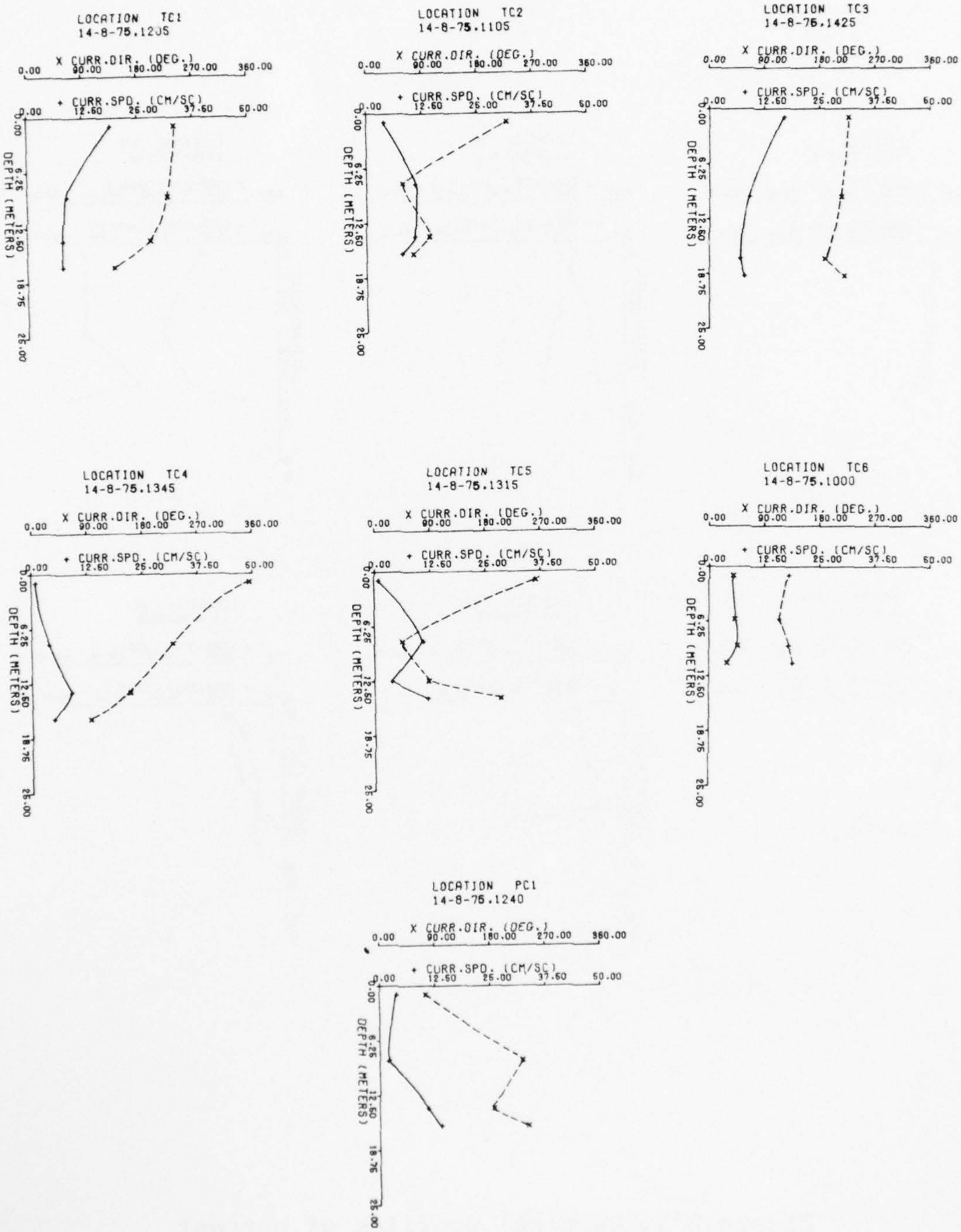

Figure H'3. Vertical profiles of current speed and direction, 14 August 1975

Figure H'4. Vertical profiles of current speed and direction, 14 September 1975

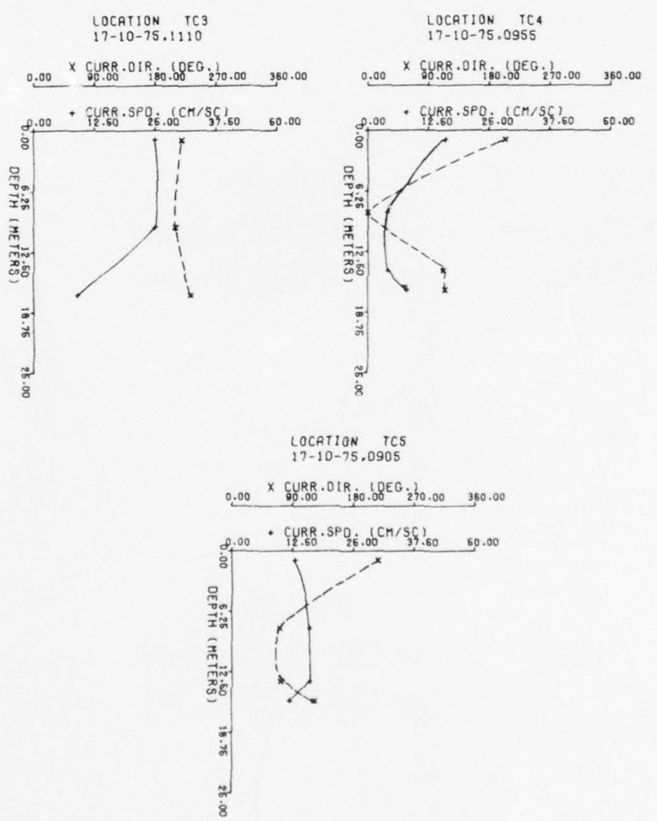

Figure H'5. Vertical profiles of current speed and direction, 17 October 1975

AD-A051 217 NALCO ENVIRONMENTAL SCIENCES NORTHBROOK IL F/G 13/2
AQUATIC DISPOSAL FIELD INVESTIGATIONS ASHTABULA RIVER DISPOSAL --ETC(U)
DEC 77 L J DANEK, G R ALTHER, P P PAILY DACW39-75-C-0108
UNCLASSIFIED WES-TR-D-77-42-APP-B NL

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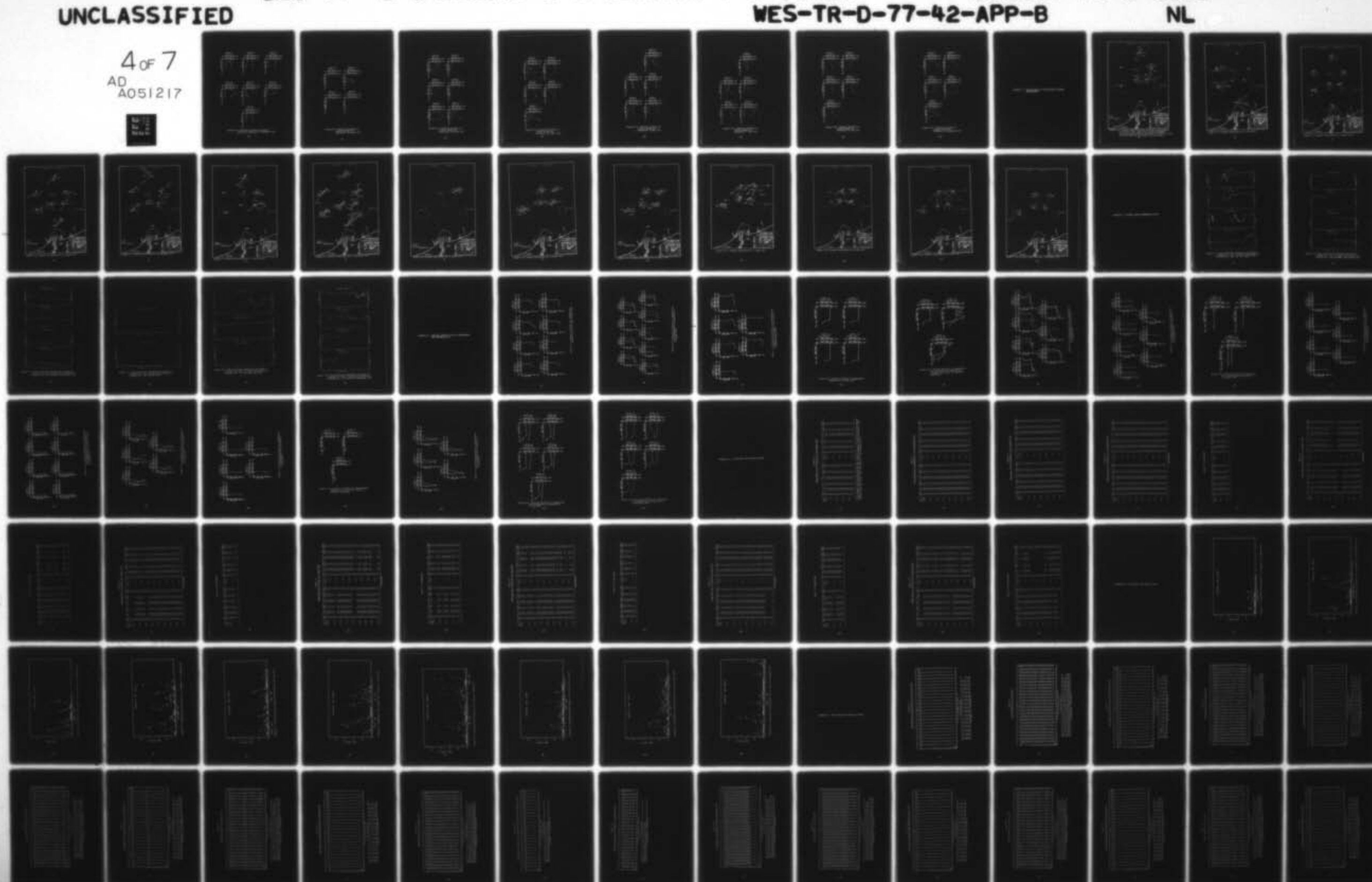
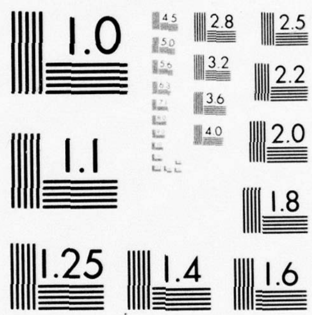
AD A051217





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

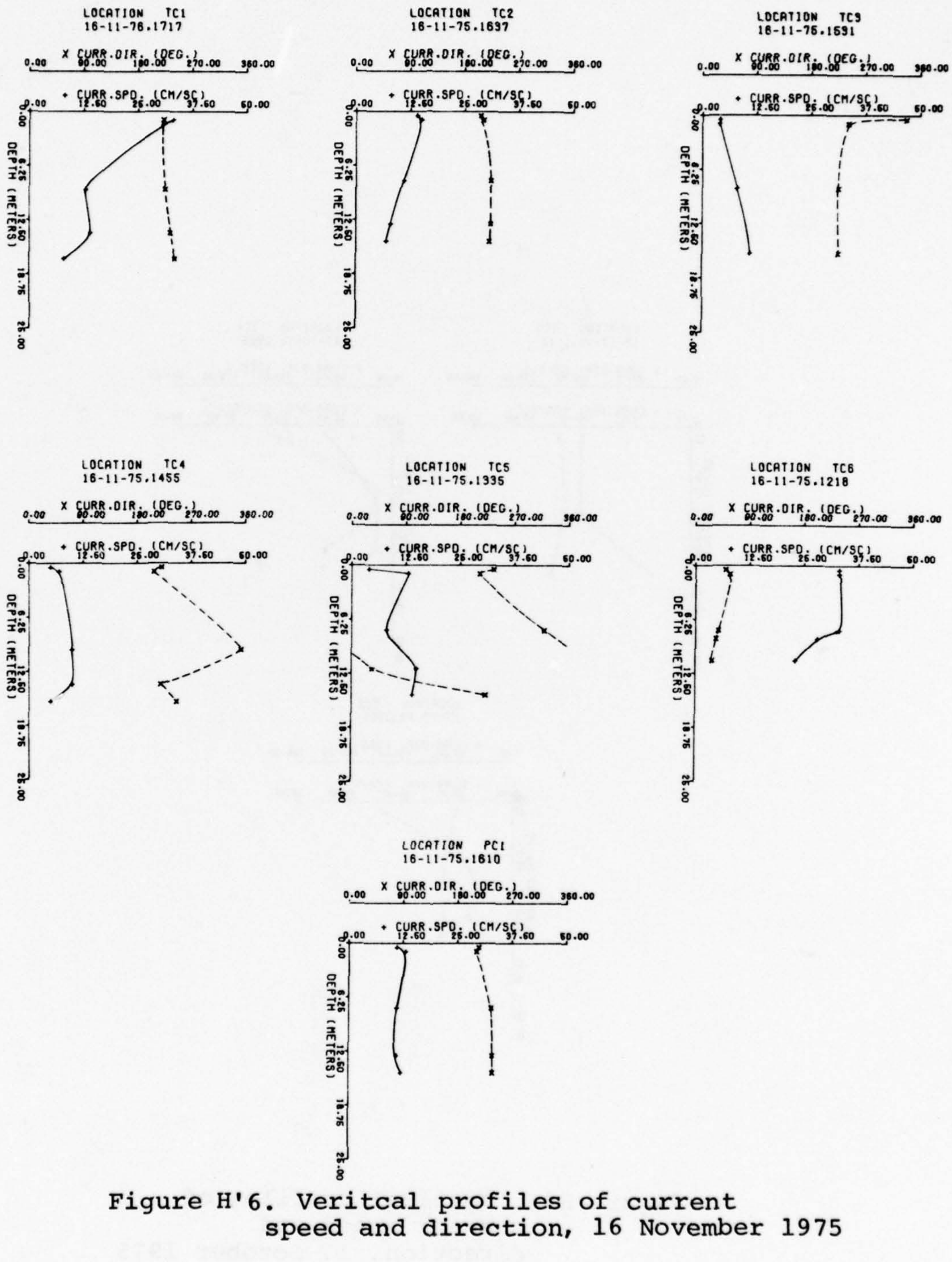


Figure H'6. Veritcal profiles of current
speed and direction, 16 November 1975

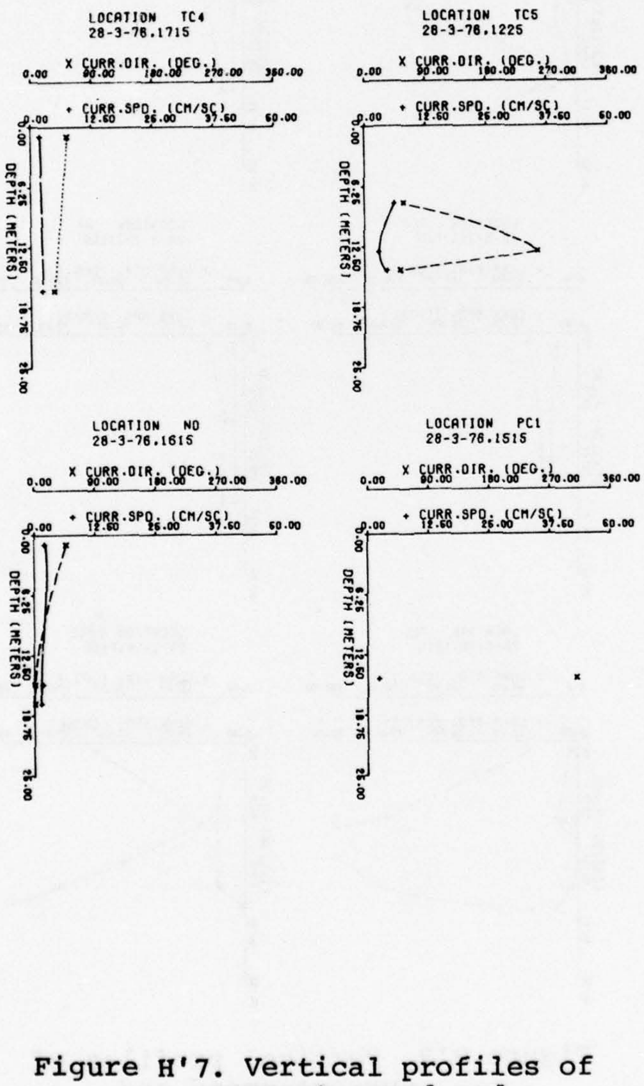


Figure H'7. Vertical profiles of current speed and direction, 28 March 1976

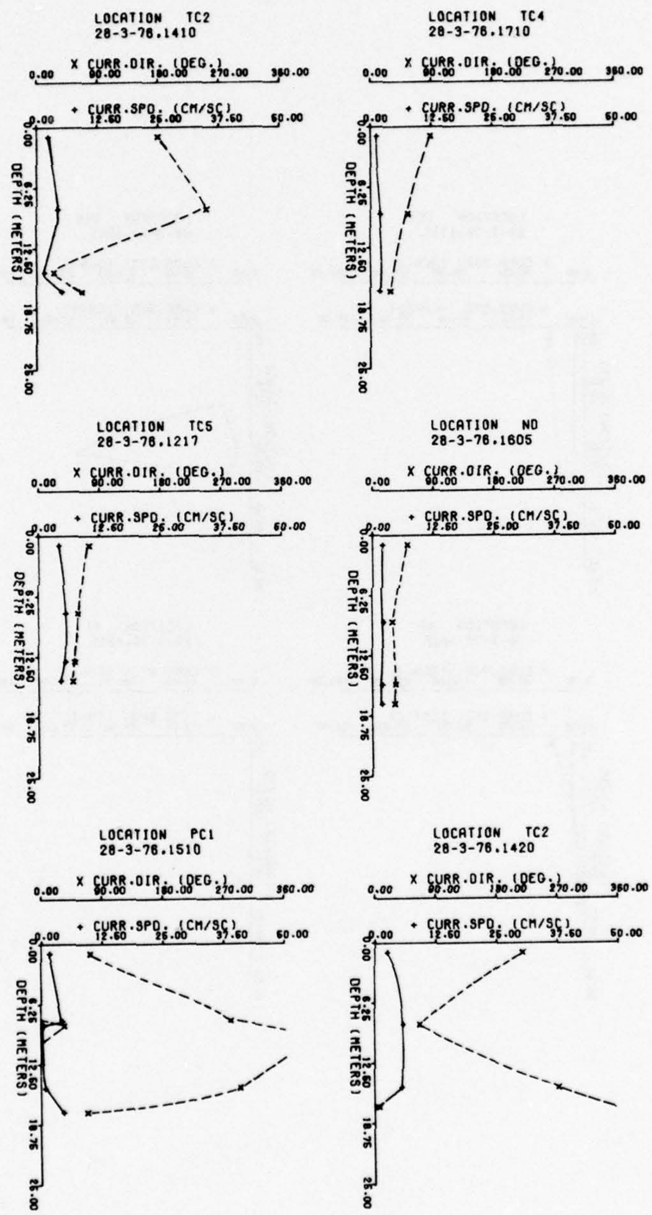


Figure H'8. Vertical profiles of current speed and direction, 28 March 1976

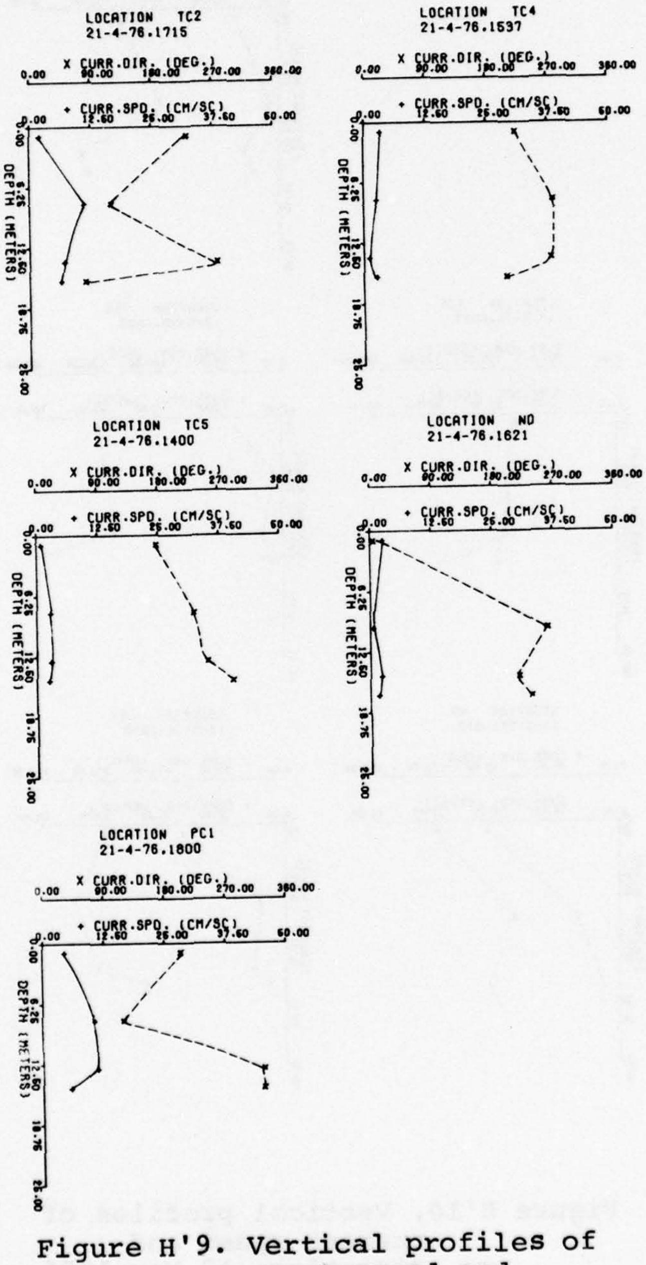


Figure H'9. Vertical profiles of current speed and direction, 21 April 1976

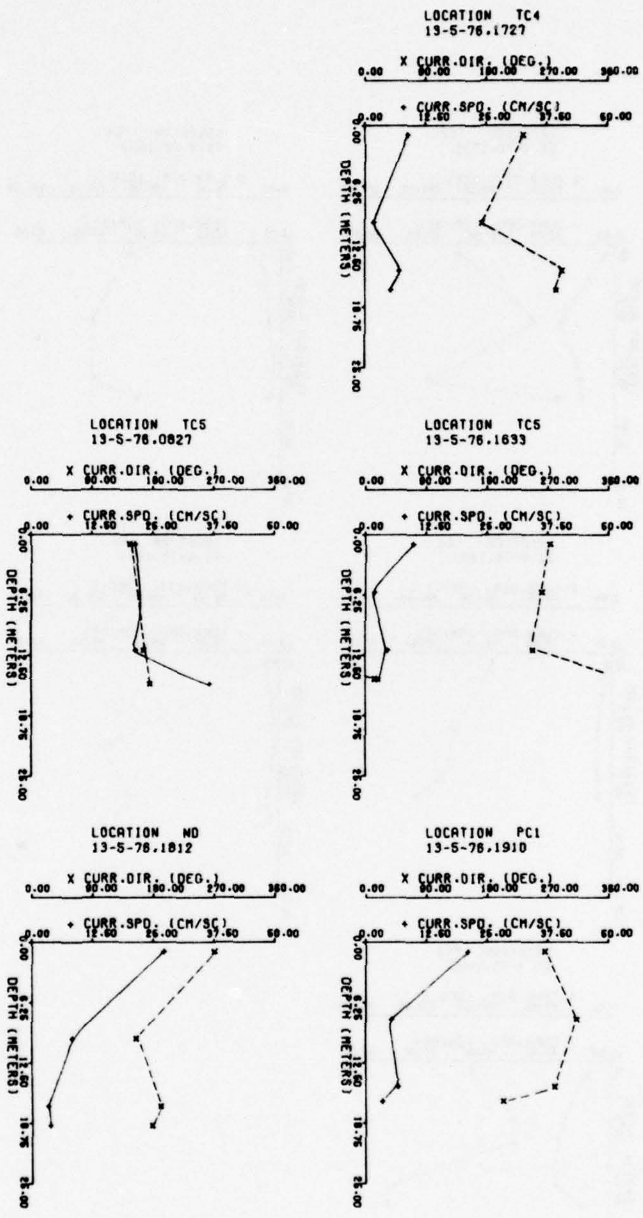


Figure H'10. Vertical profiles of
current speed and
direction, 13 May 1976

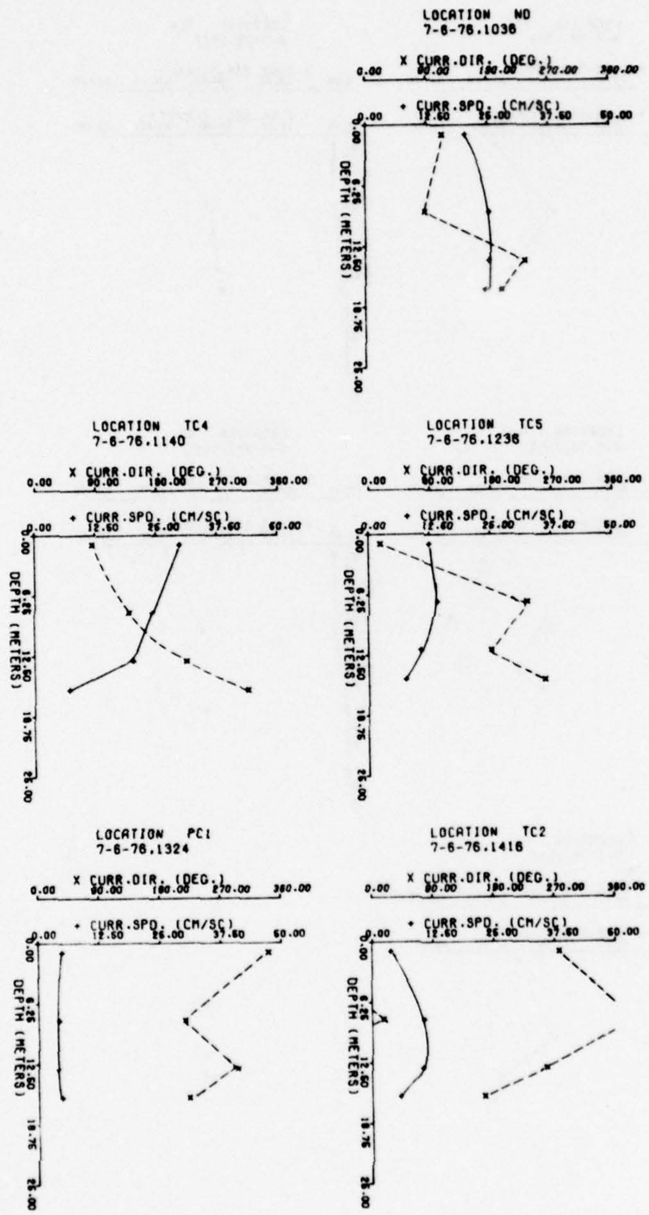


Figure H'11. Vertical profiles of current speed and direction, 7 June 1976

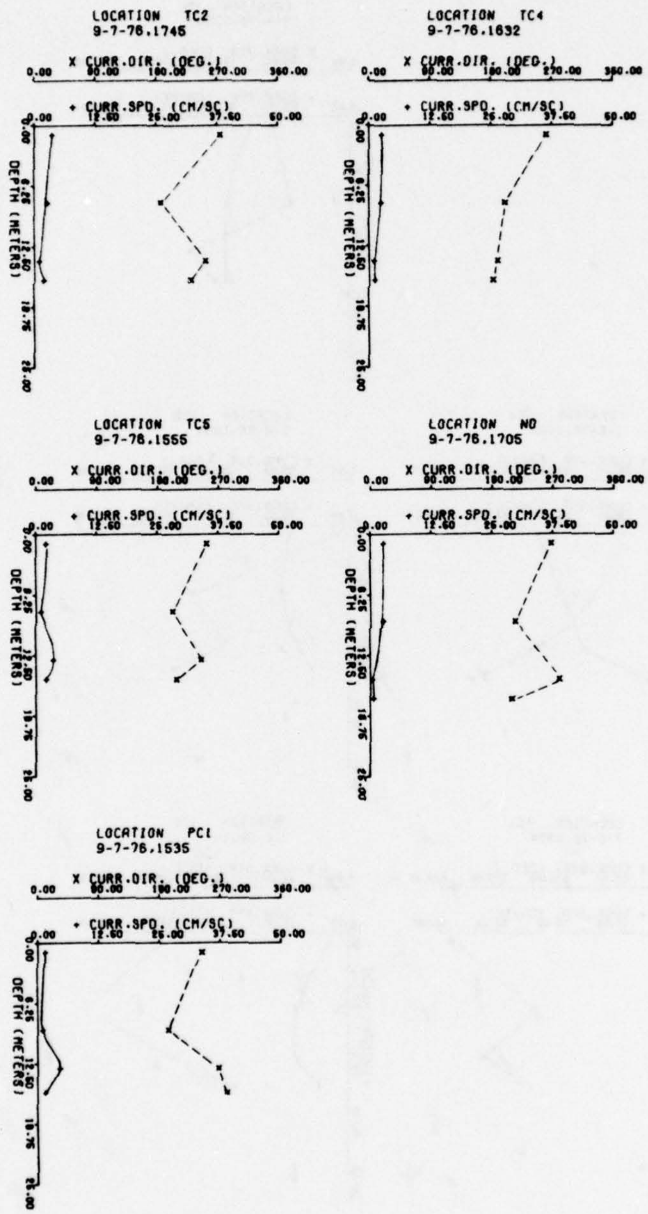


Figure H'12. Vertical profiles of current speed and direction, 9 July 1976

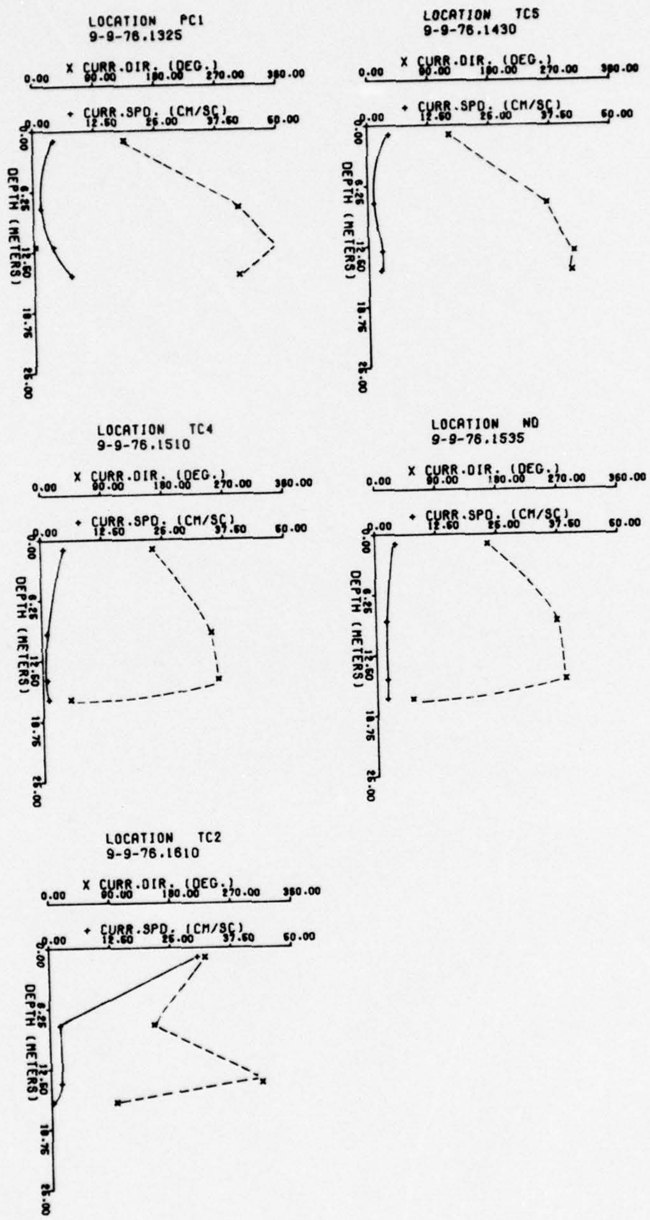


Figure H'13. Vertical profiles of current speed and direction, 9 September 1976

APPENDIX I': VECTOR PLOTS OF OVER-THE-SIDE CURRENT MEASUREMENTS

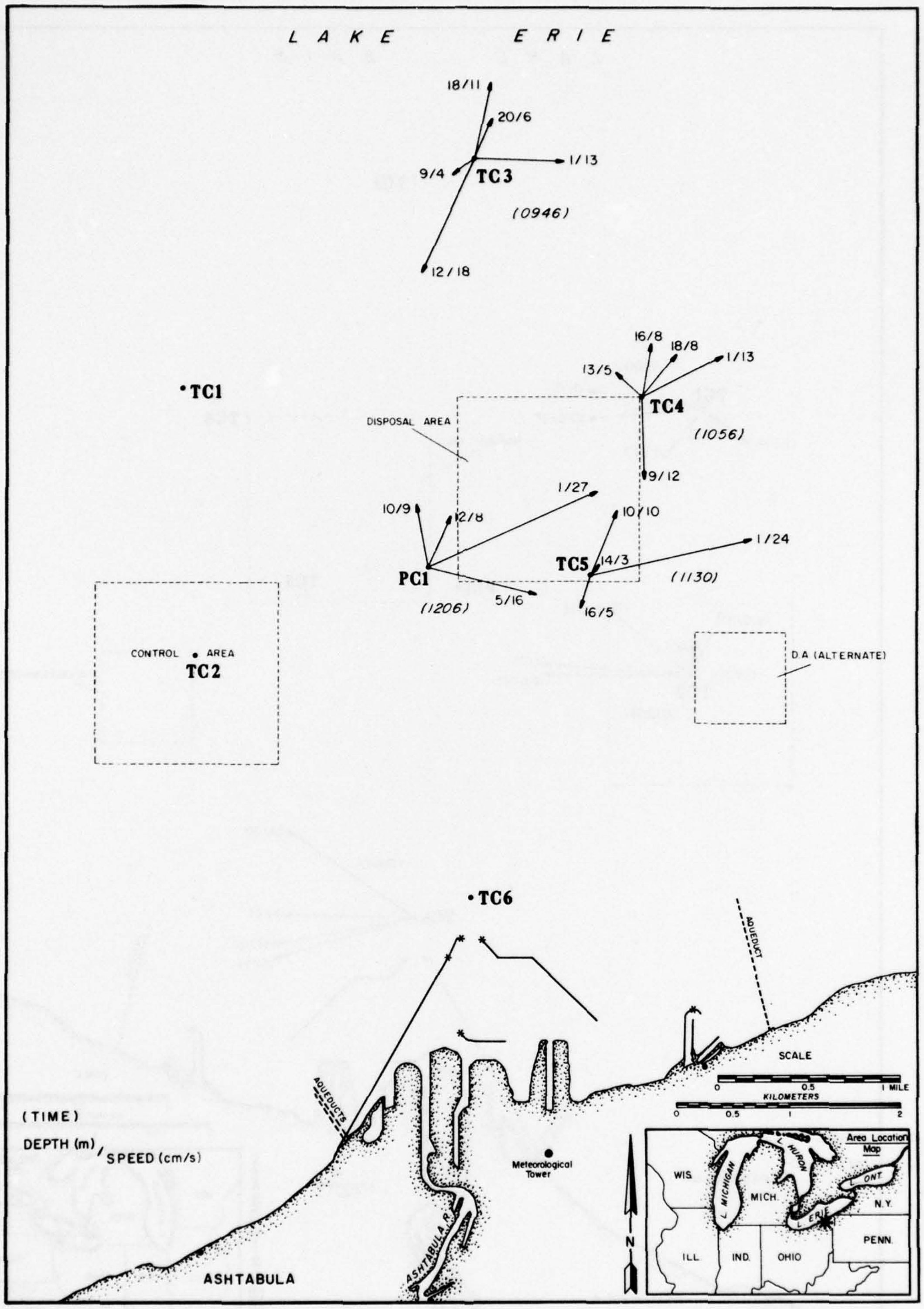


Figure I'1. Current velocities from shipboard measurements on 10 July 1975. The time of the measurement is given in parenthesis, the depth in meters is also given followed by the speed for each vector

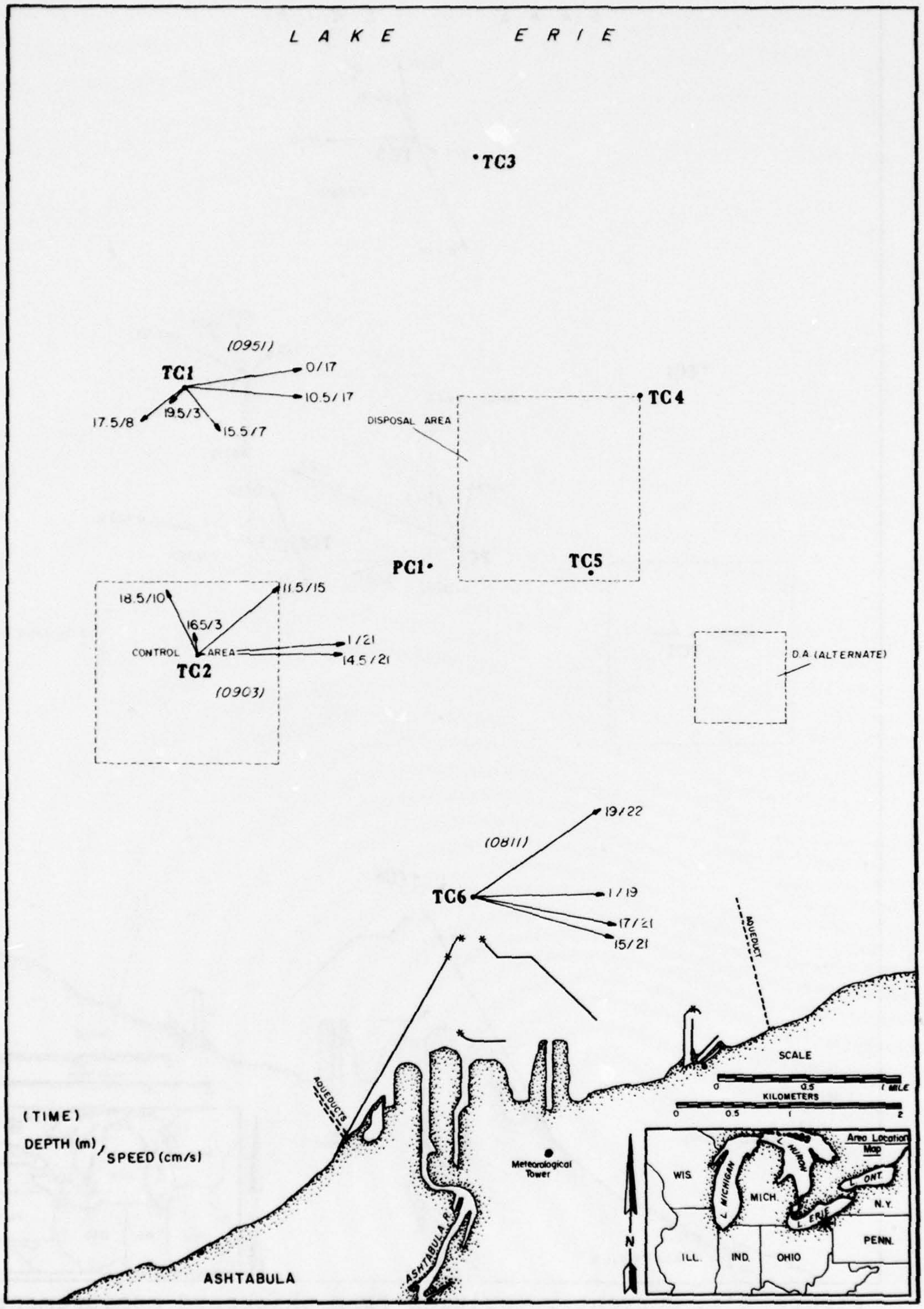


Figure I'2. Current velocities for 11 July 1975

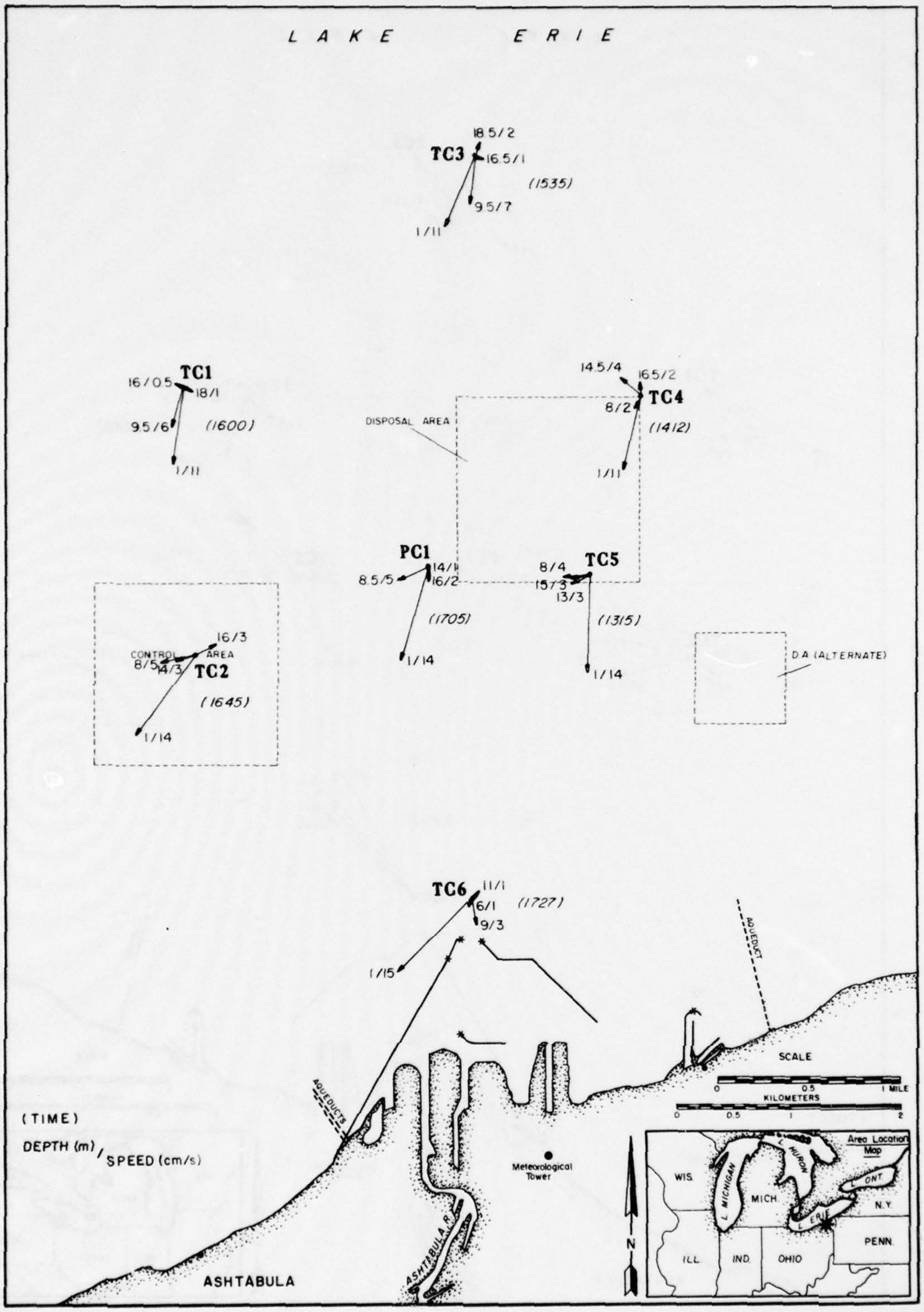


Figure I'3. Current velocities for 1 August 1975

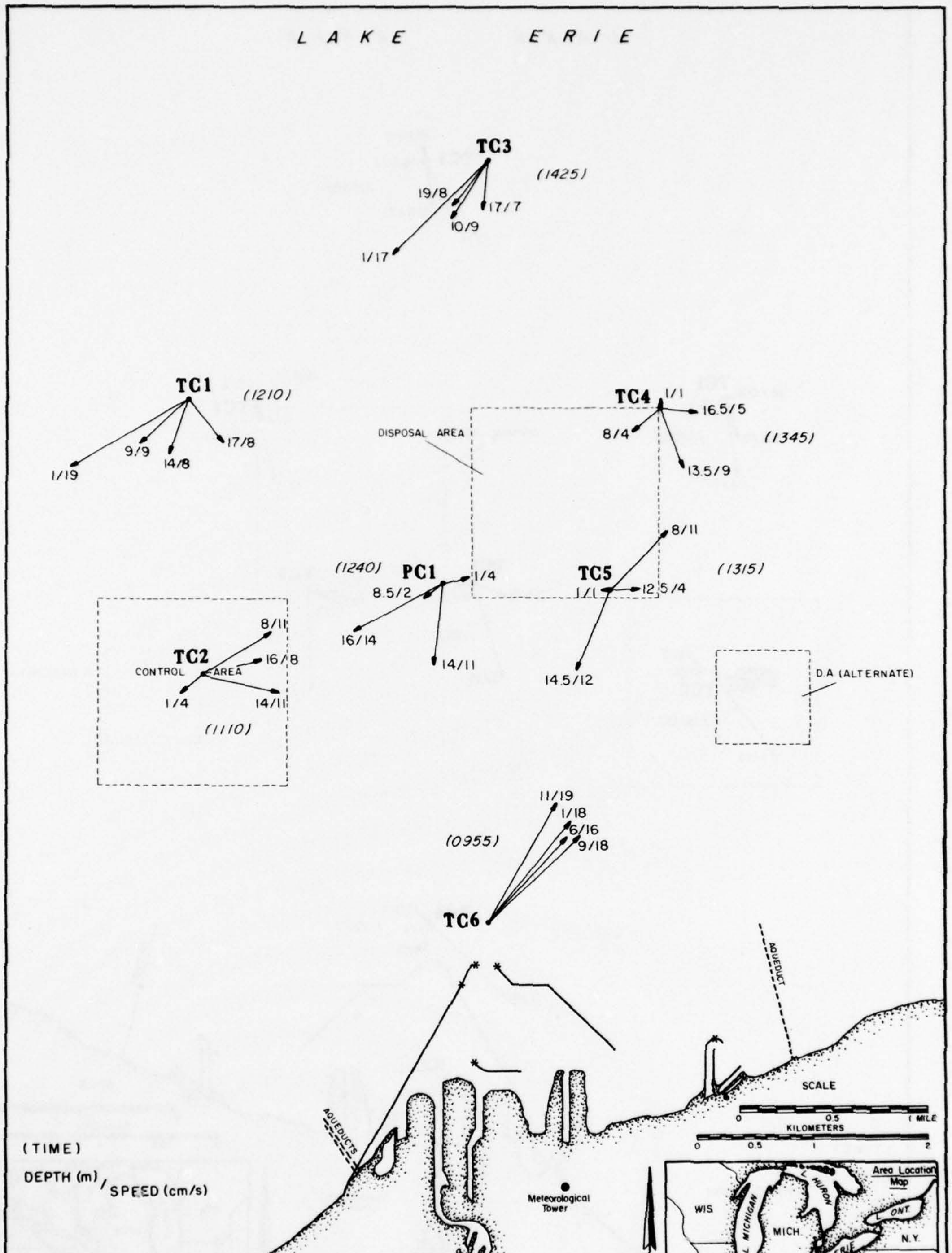


Figure I'4. Current velocities for 14 August 1975

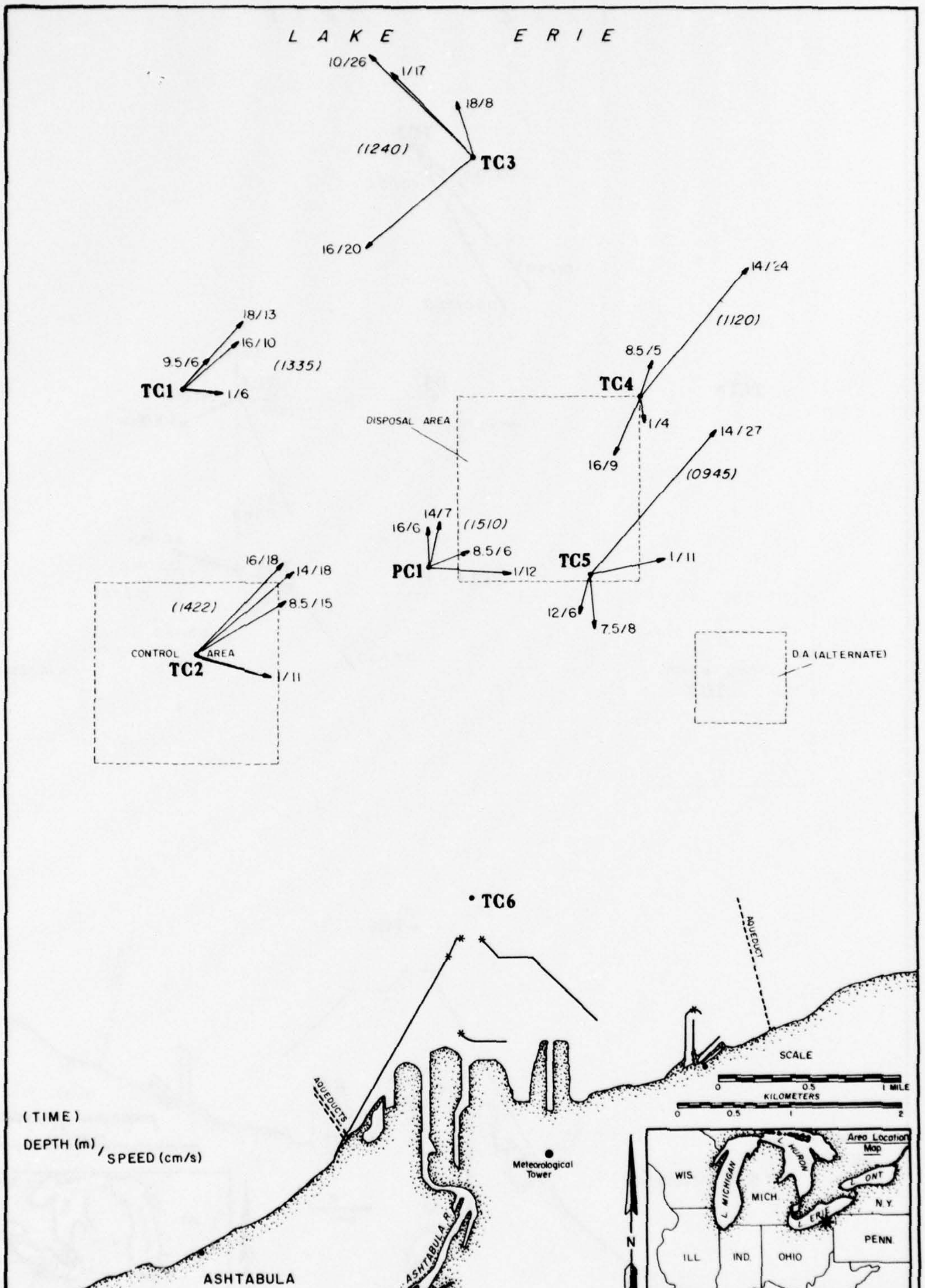


Figure I'5. Current velocities of 14 September 1975

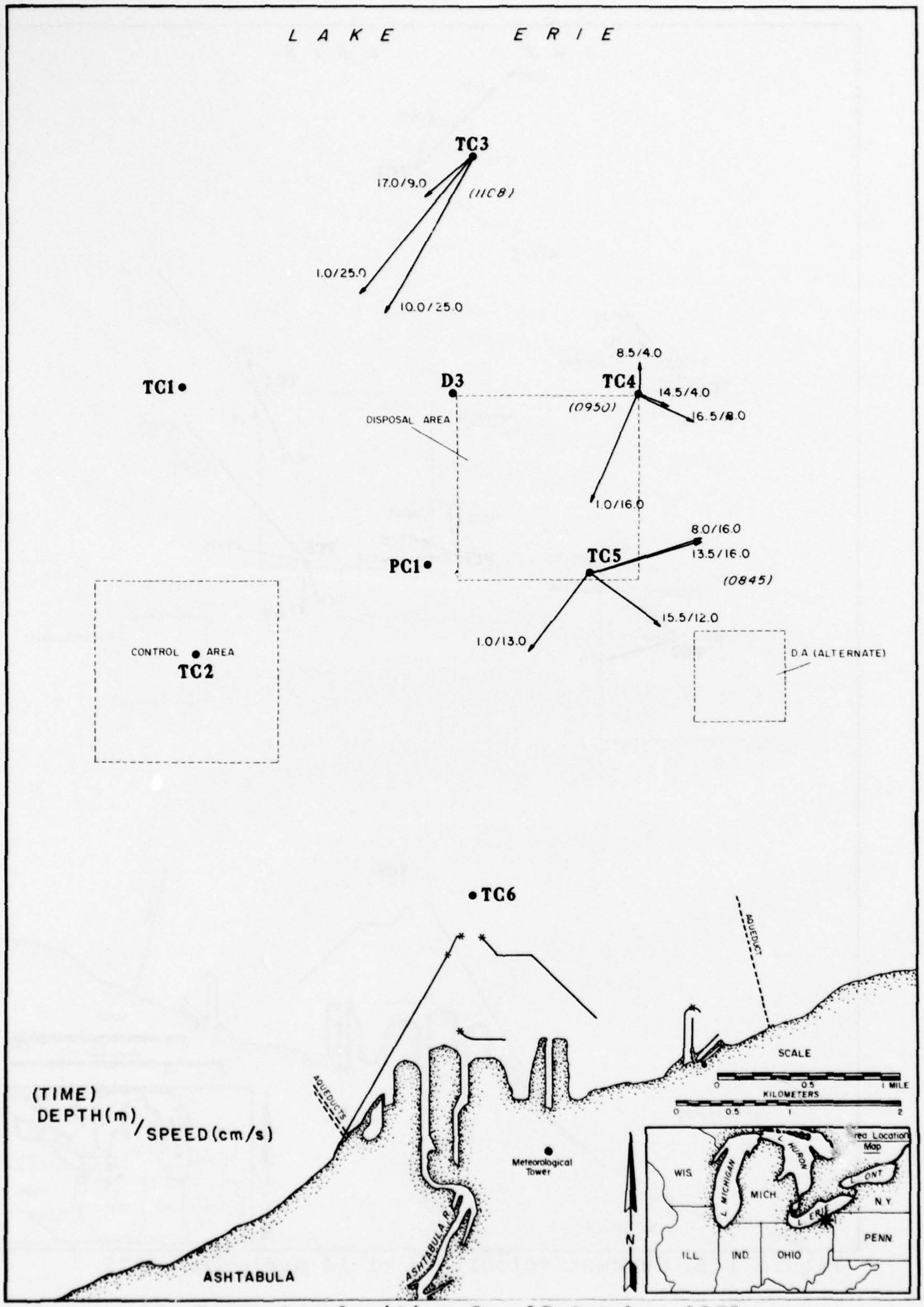


Figure I'6. Current velocities for 17 October 1975

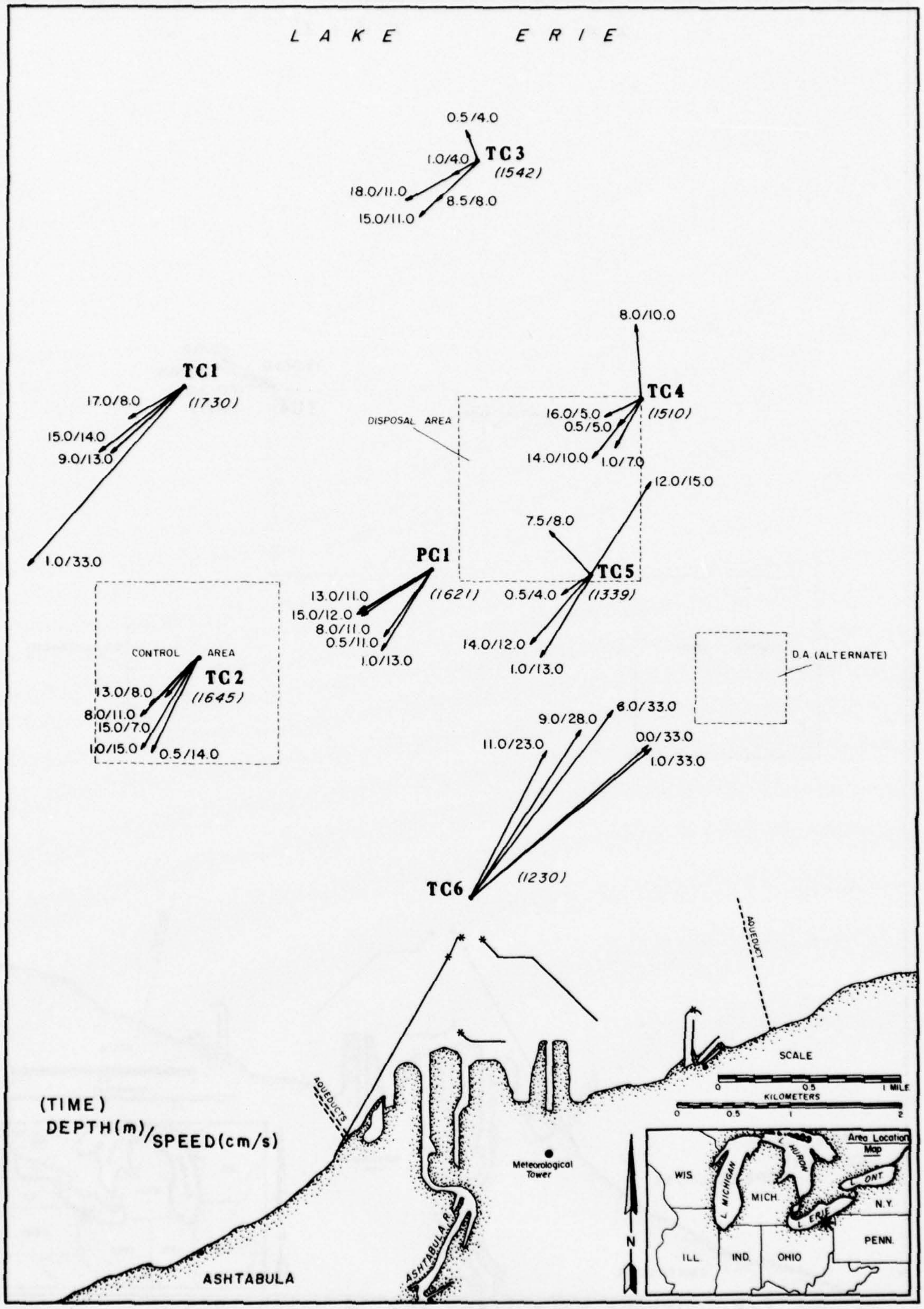


Figure I'7. Current velocities for 16 November 1975

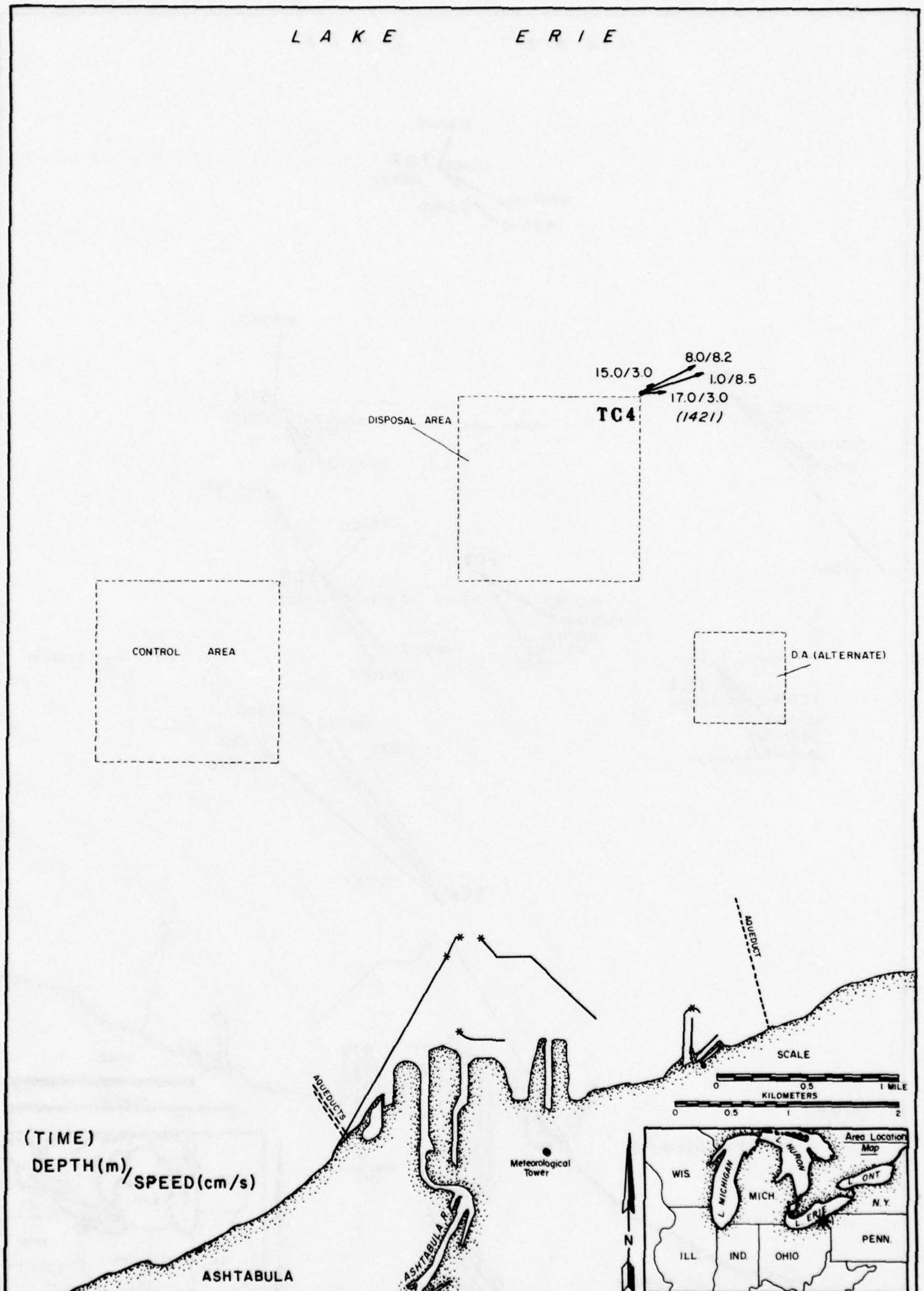


Figure I'8. Current velocities for 26 March 1975

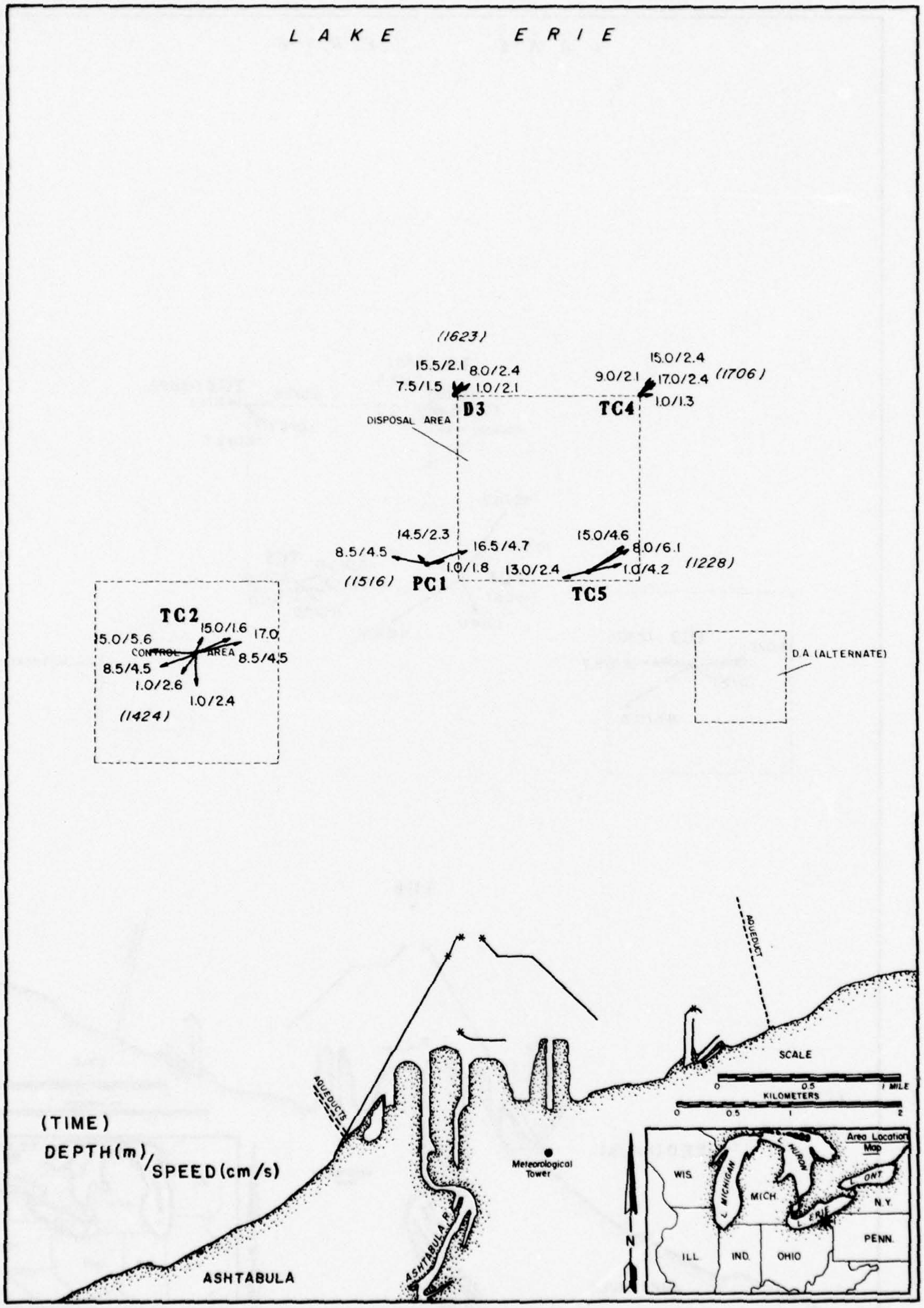


Figure I'9. Current velocities for 28 March 1976

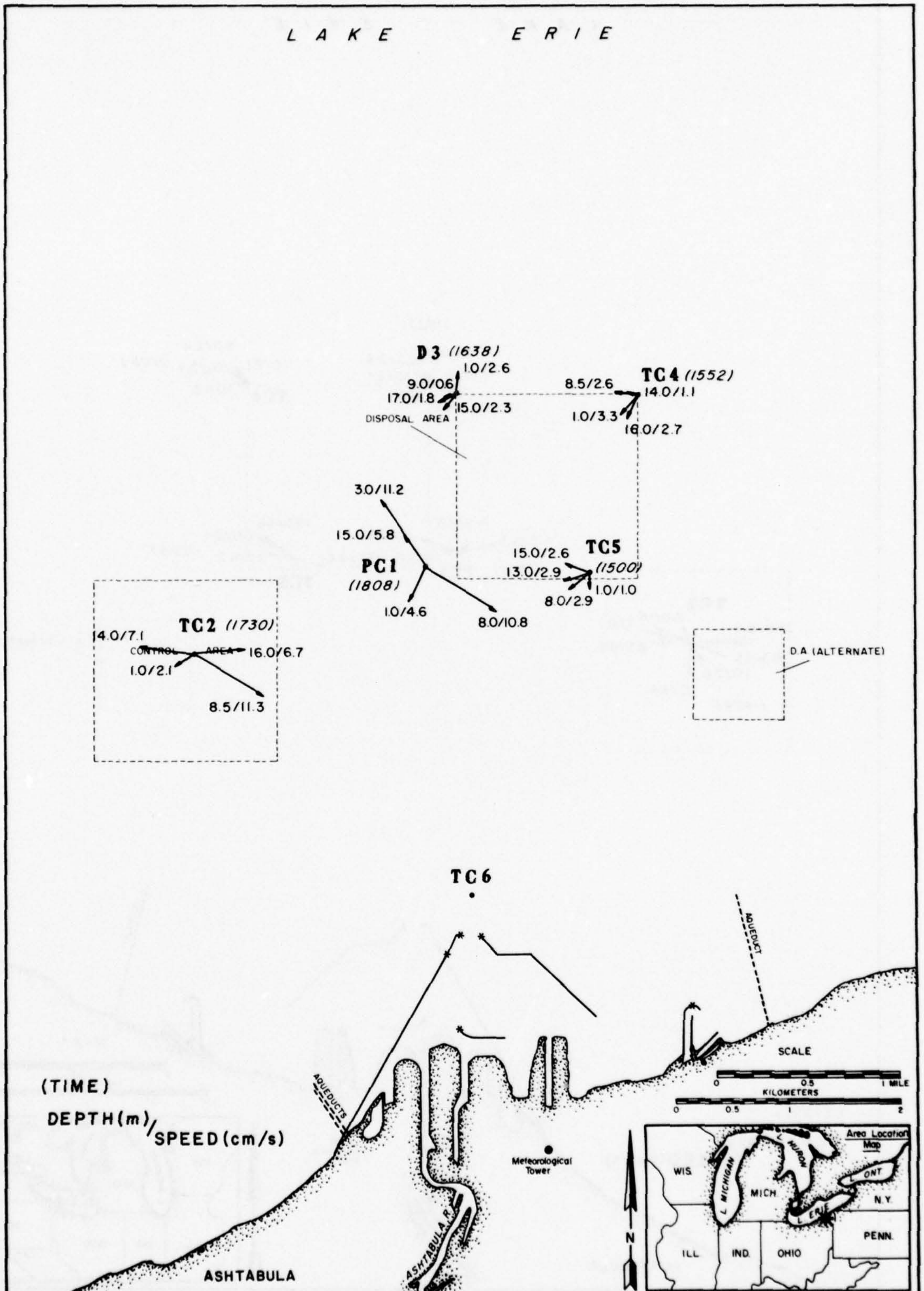


Figure I'10. Current velocities for 21 April 1976

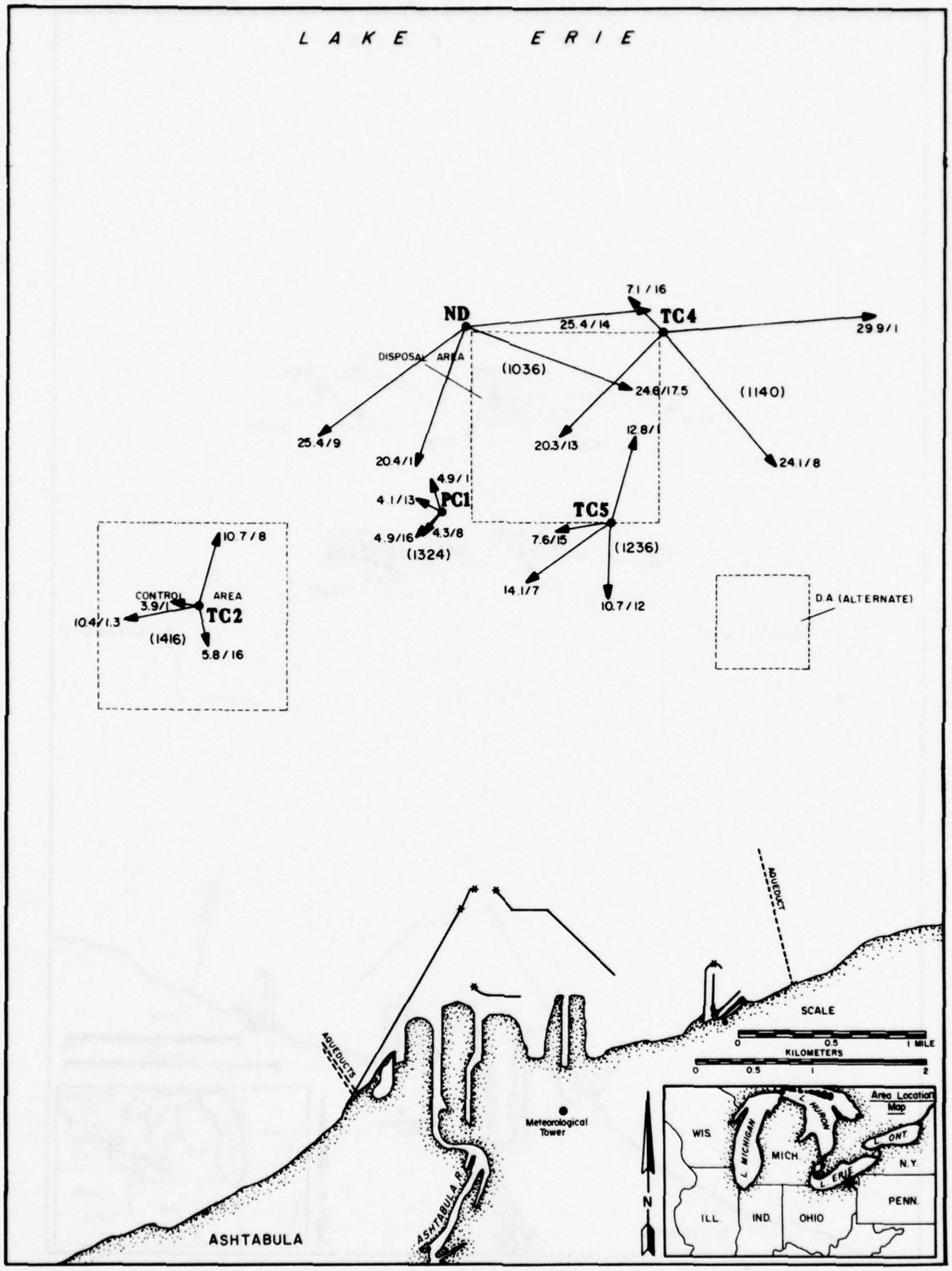


Figure I'11. Current velocities for 7 June 1976

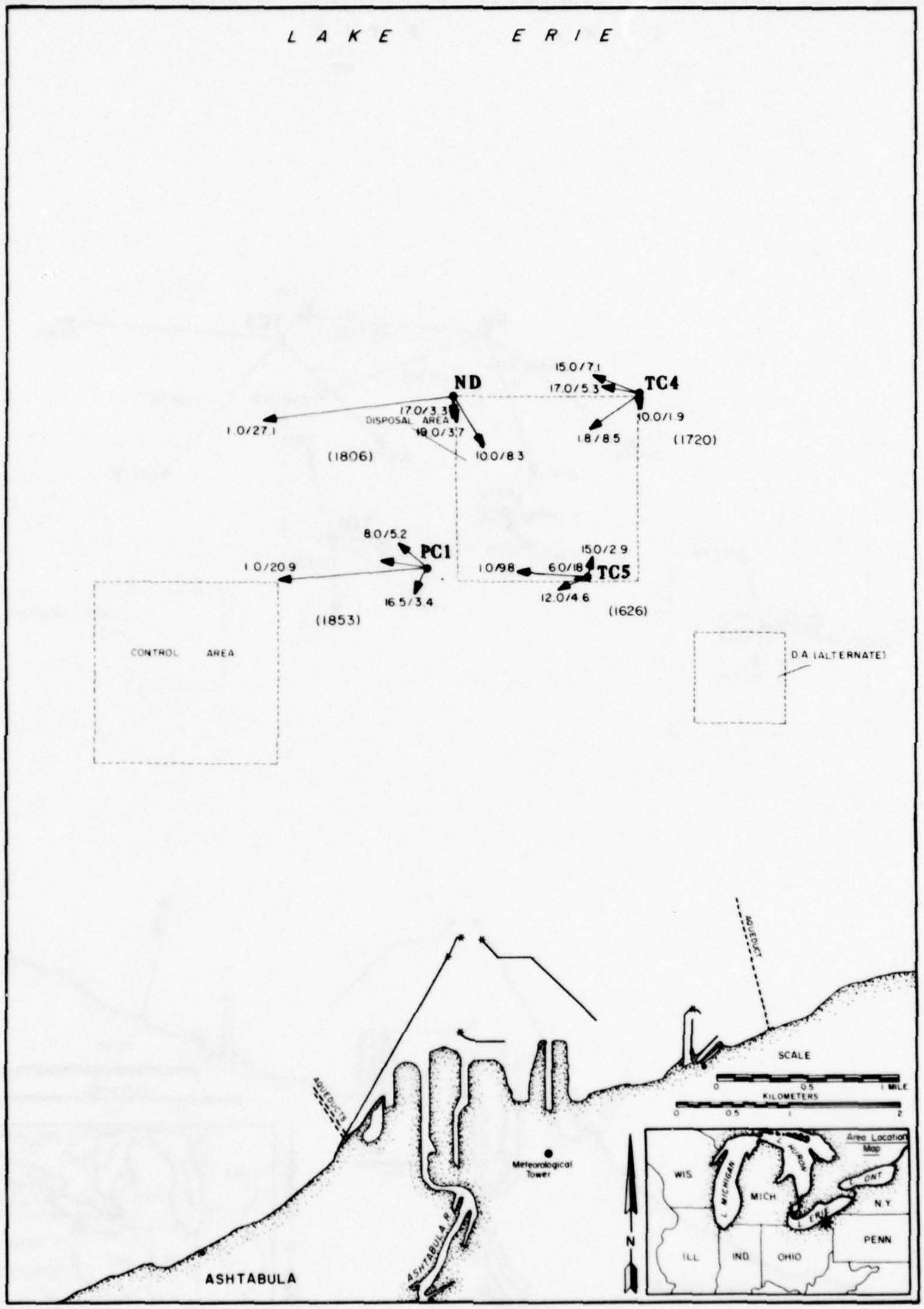


Figure I'12. Current velocities for 13 May 1976

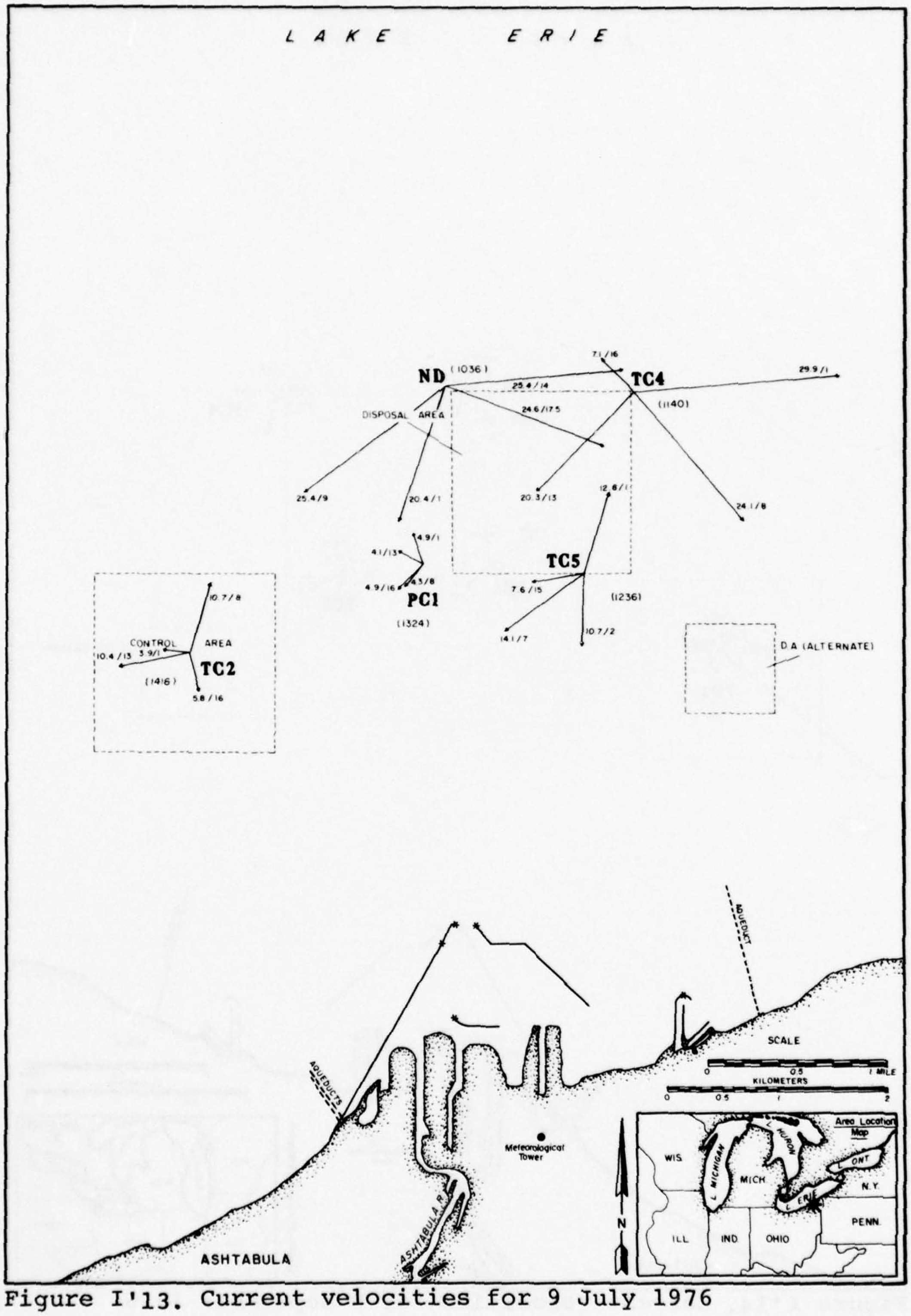


Figure I'13. Current velocities for 9 July 1976

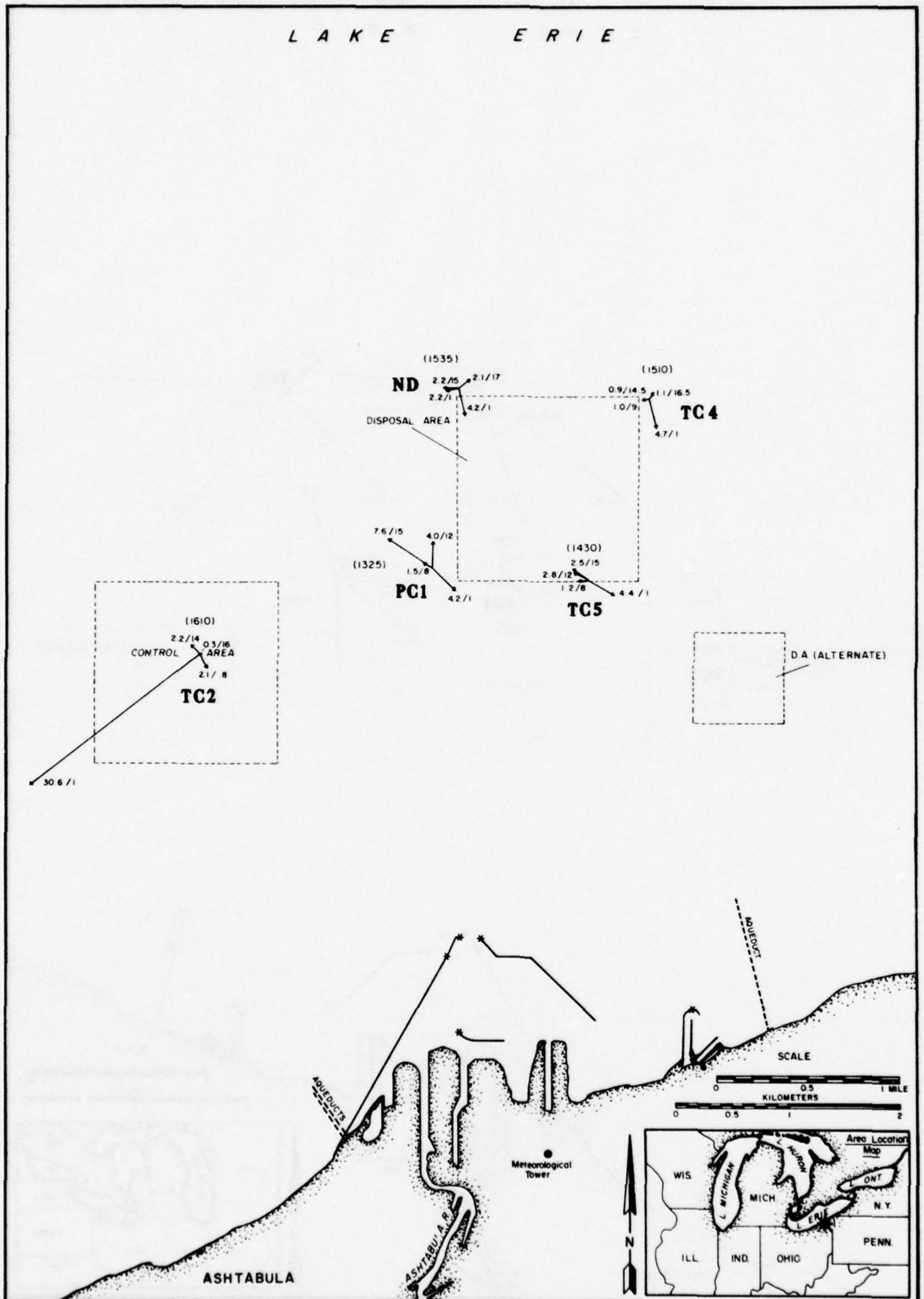


Figure I'14. Current velocities for 9 September 1976

APPENDIX J': MONTHLY WATER TEMPERATURE PLOTS

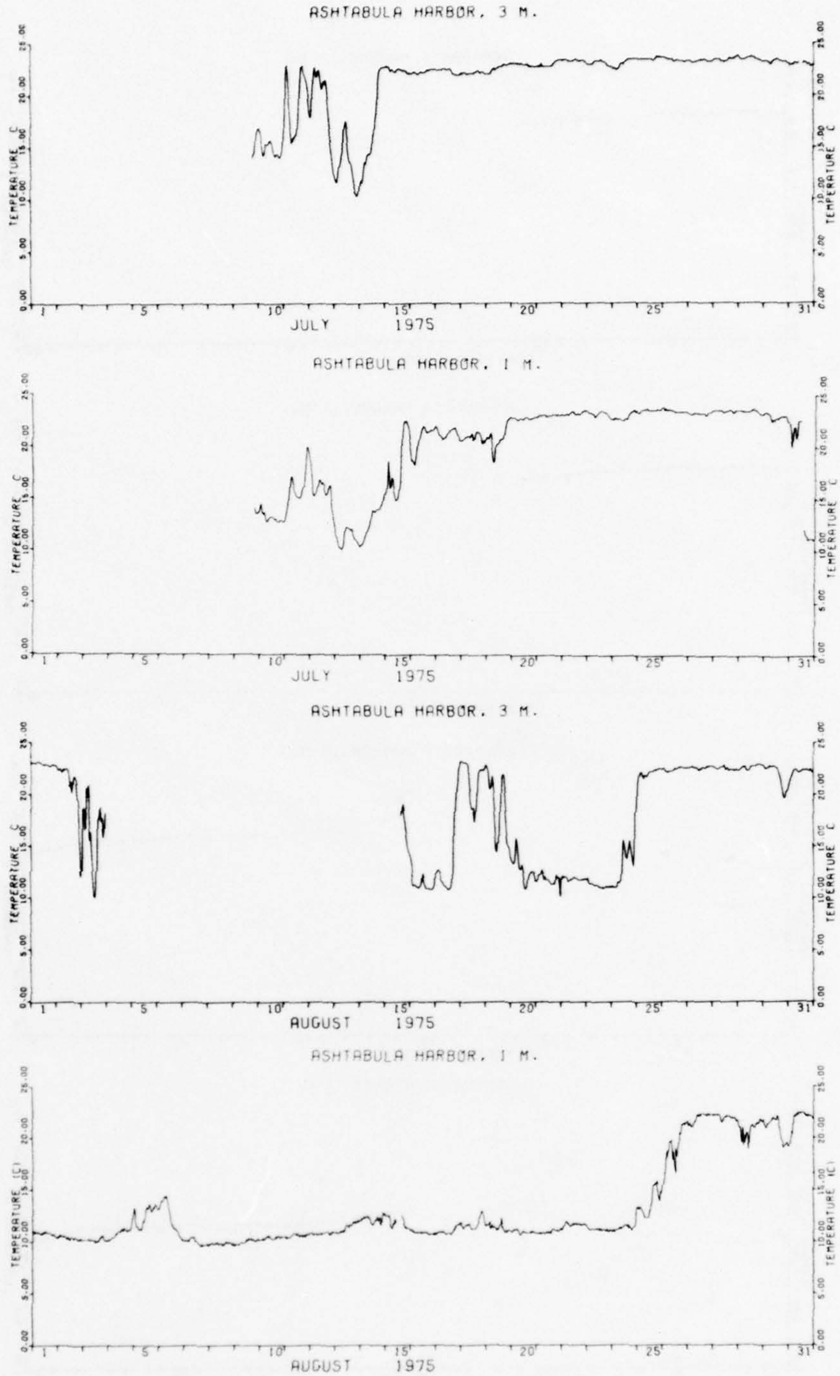


Figure J'1. Time continuous temperature recorded at a height of 1 and 3 m above lake bottom at location PC1, for July and August 1975

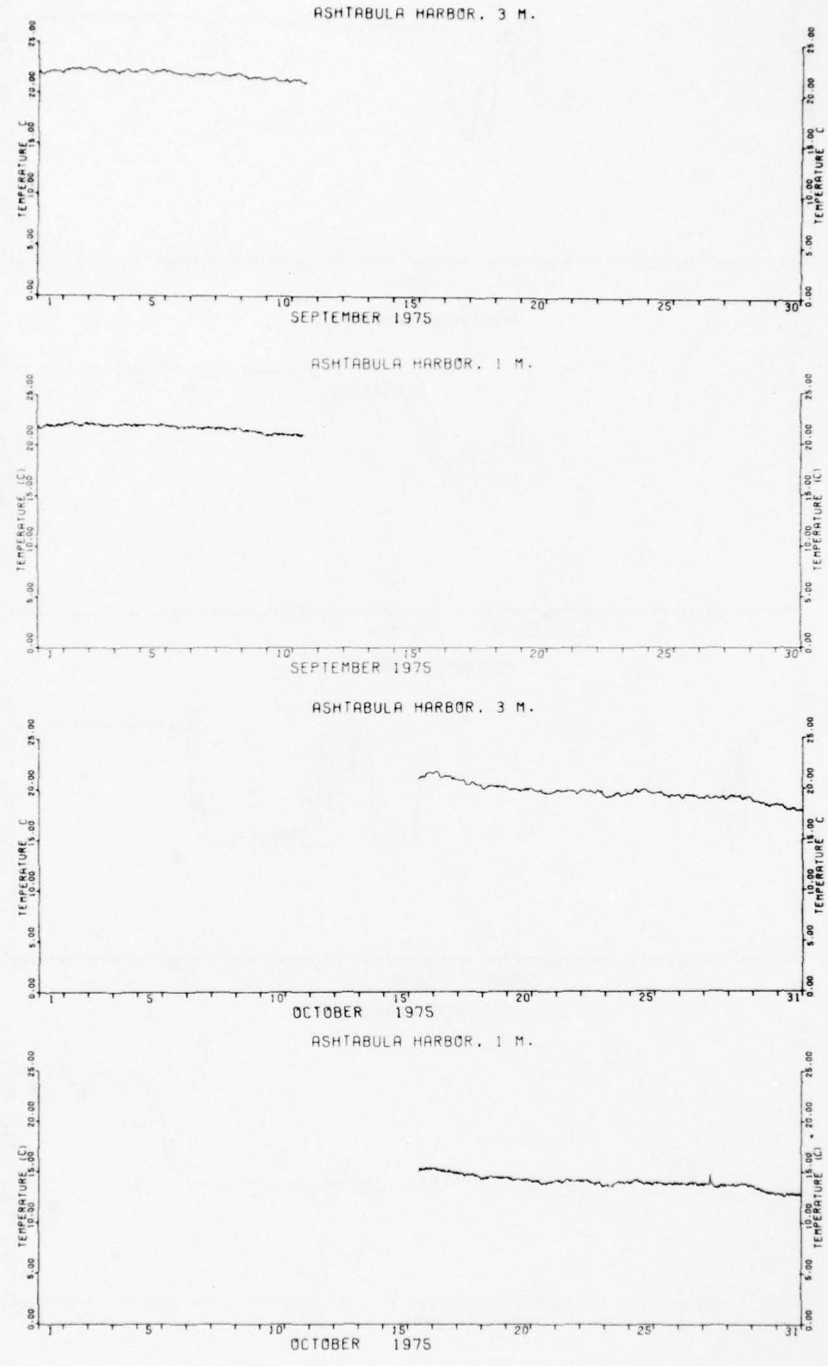


Figure J'2. Time continuous temperature recorded at a height of 1 and 3 m above lake bottom at location PC1, for September and October 1975

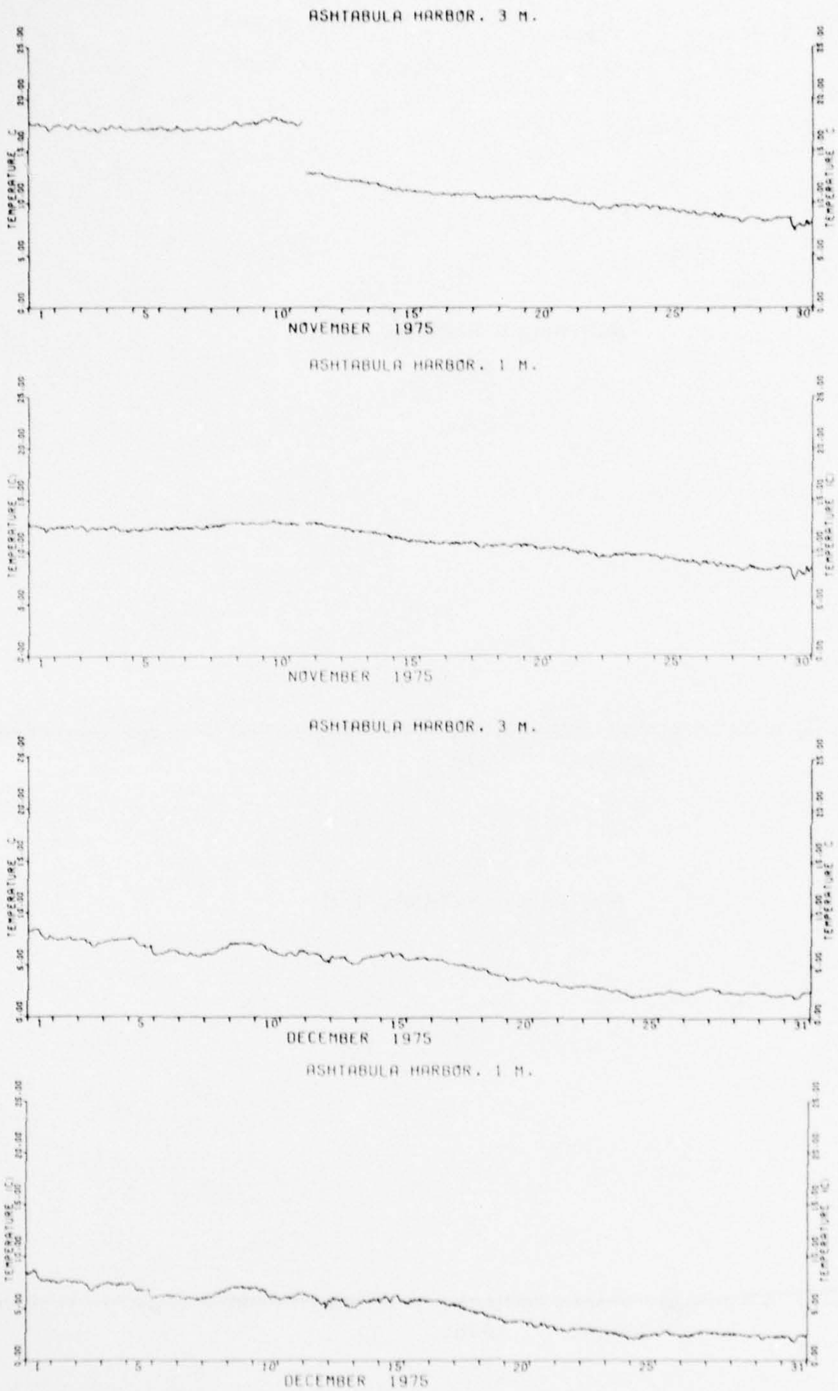


Figure J'3. Time continuous temperature recorded at a height of 1 and 3 m above lake bottom at location PC1, for November and December 1975

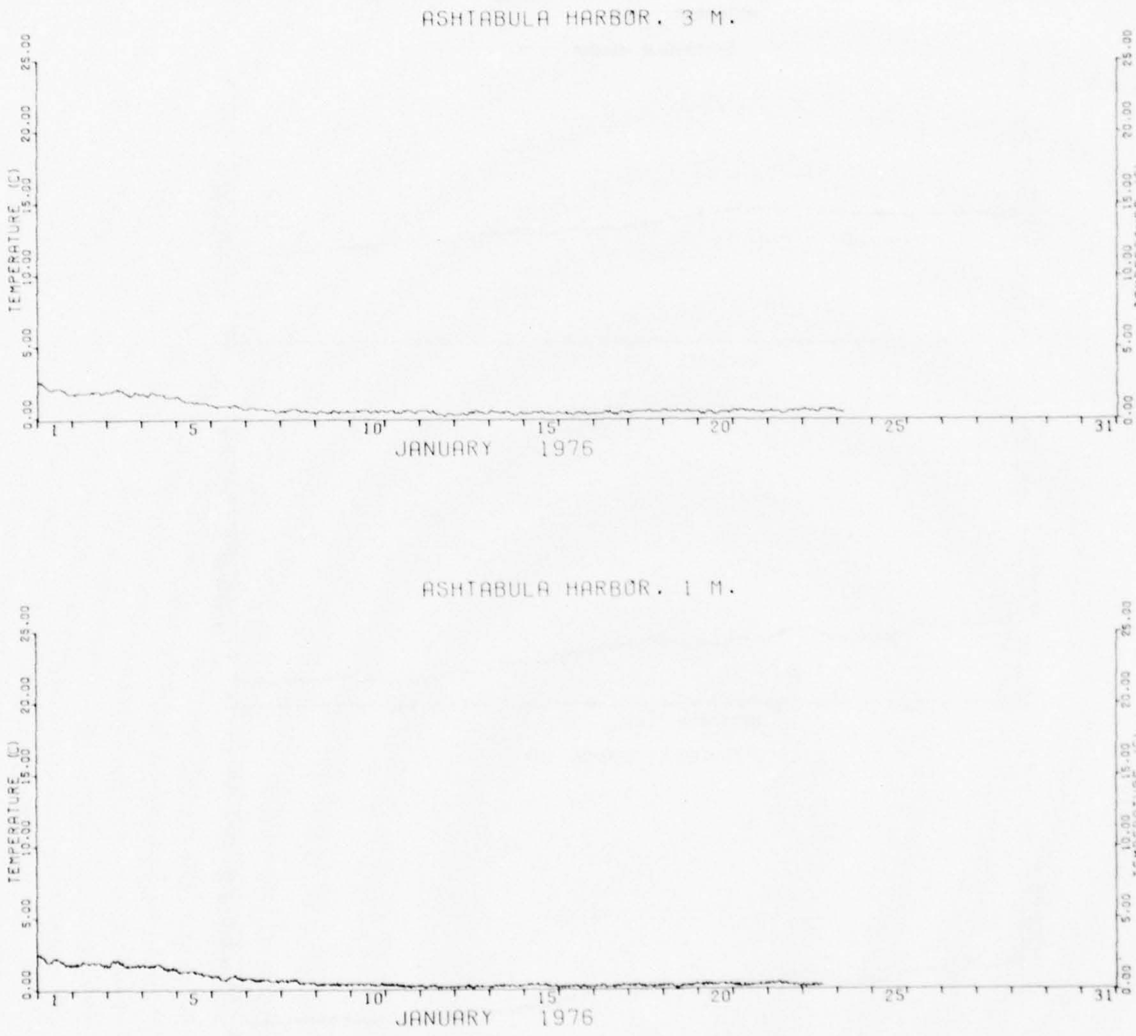


Figure J'4. Time continuous temperature recorded at a height of 1 and 3 m above lake bottom at location PC1, for January 1976

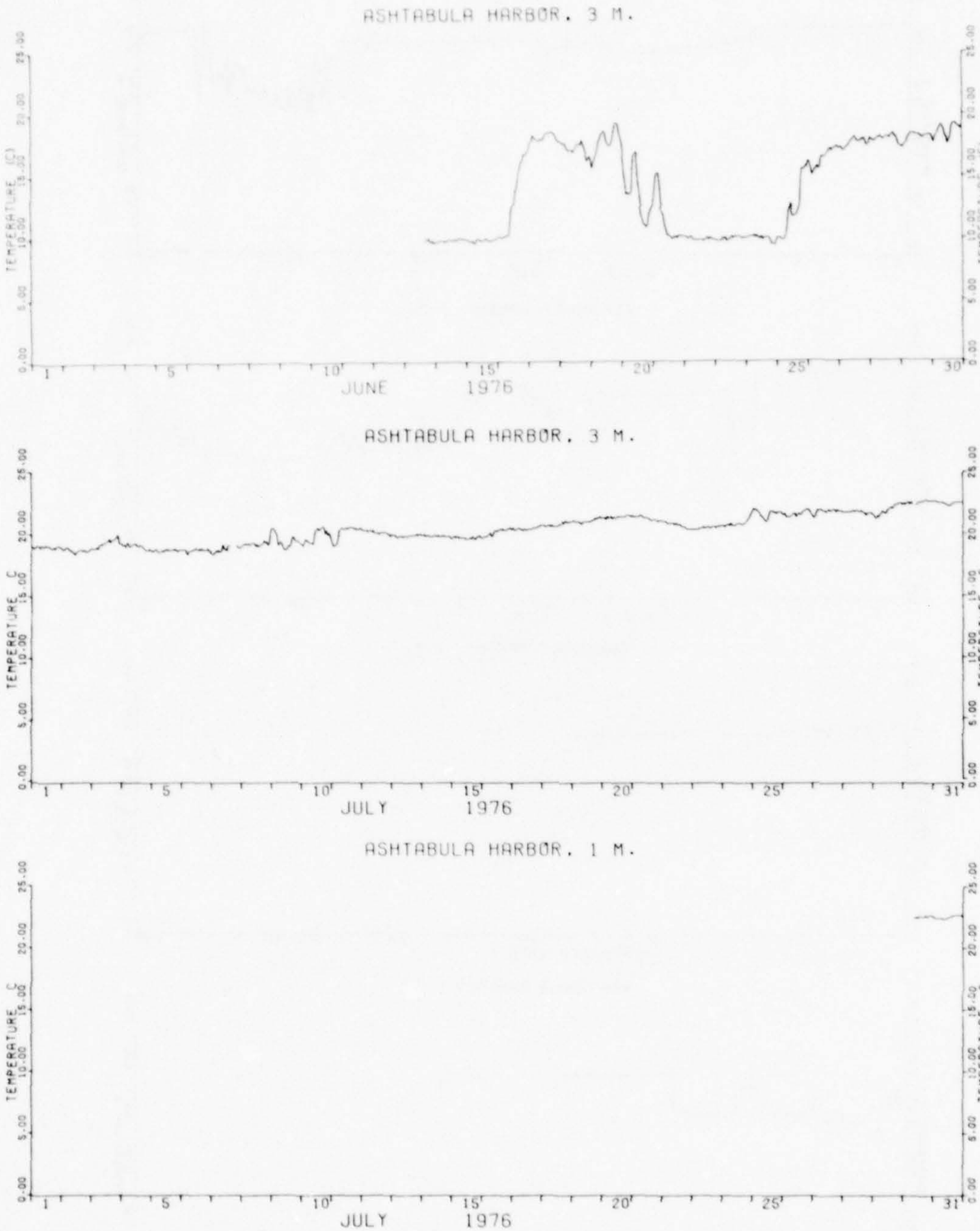


Figure J'5. Time continuous temperature recorded at a height of 1 and 3 m above lake bottom at location PC1, for June and July 1976

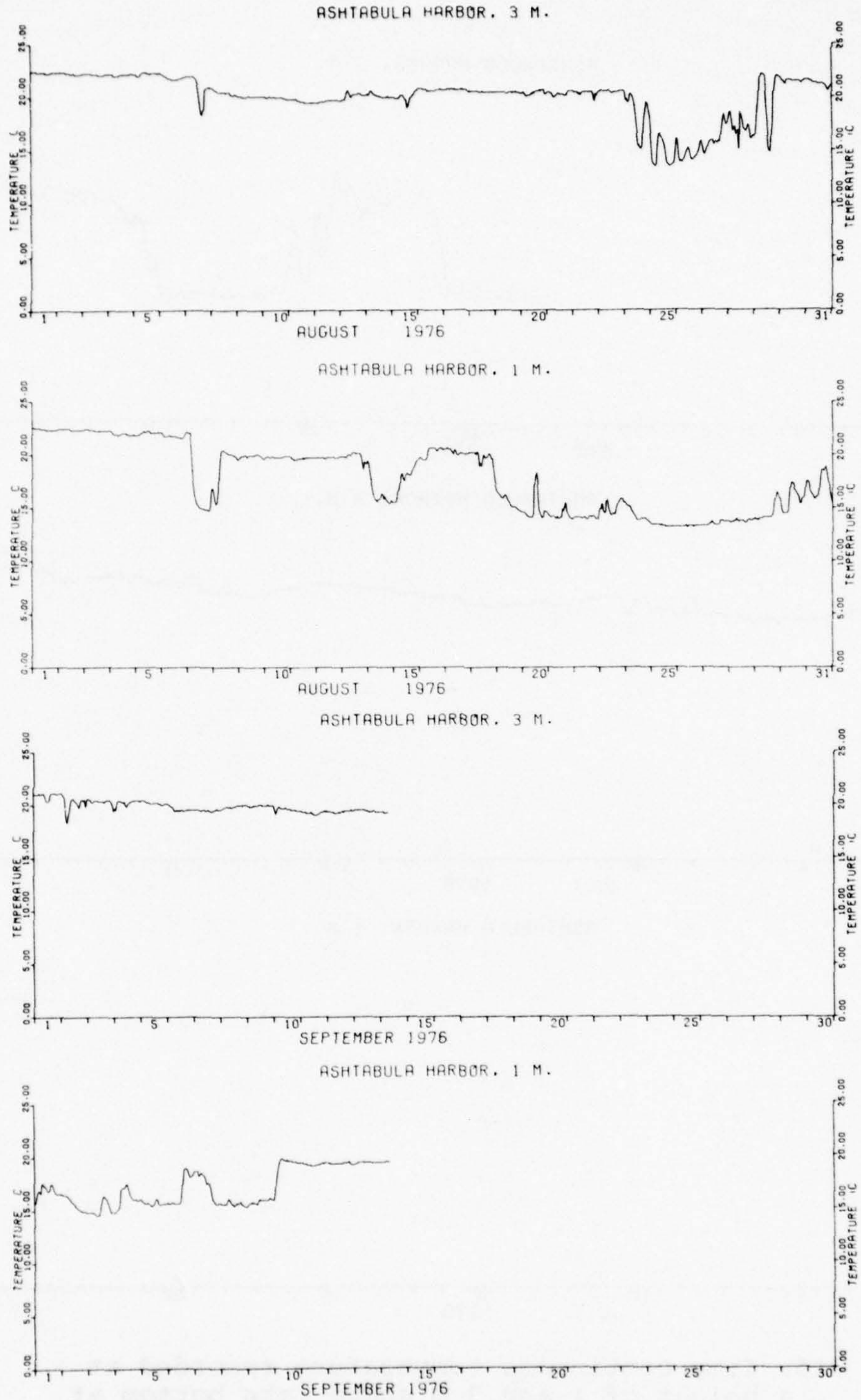


Figure J'6. Time continuous temperature recorded at a height of 1 and 3 m above lake bottom at location PC1, for August and September 1976

APPENDIX K': VERTICAL PROFILE PLOTS OF TEMPERATURE AND TRANSMISSIVITY

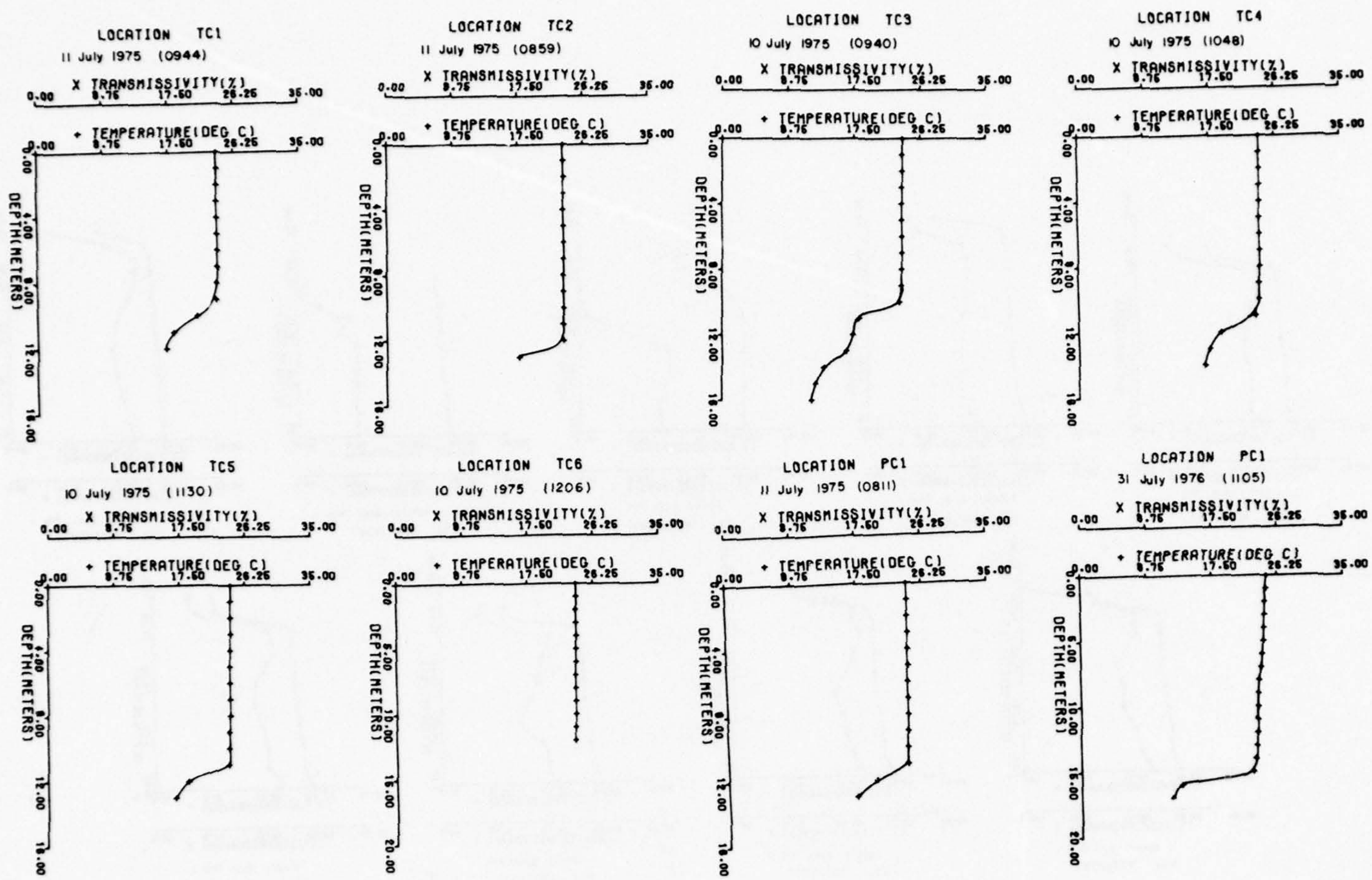


Figure K'1. Vertical profiles of temperature measured on 10,11, and 31 July 1975

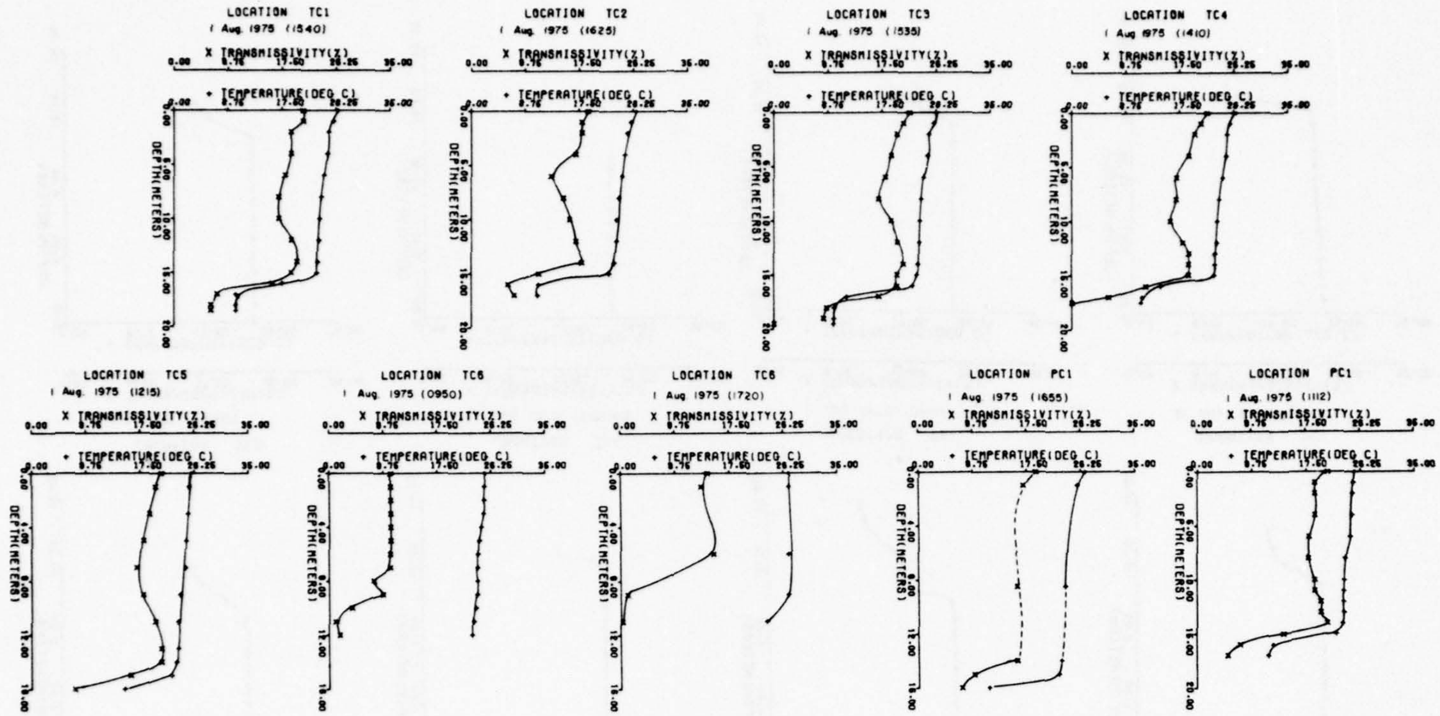


Figure K'2. Vertical profiles of temperature and transmissivity measured on 1 August 1975

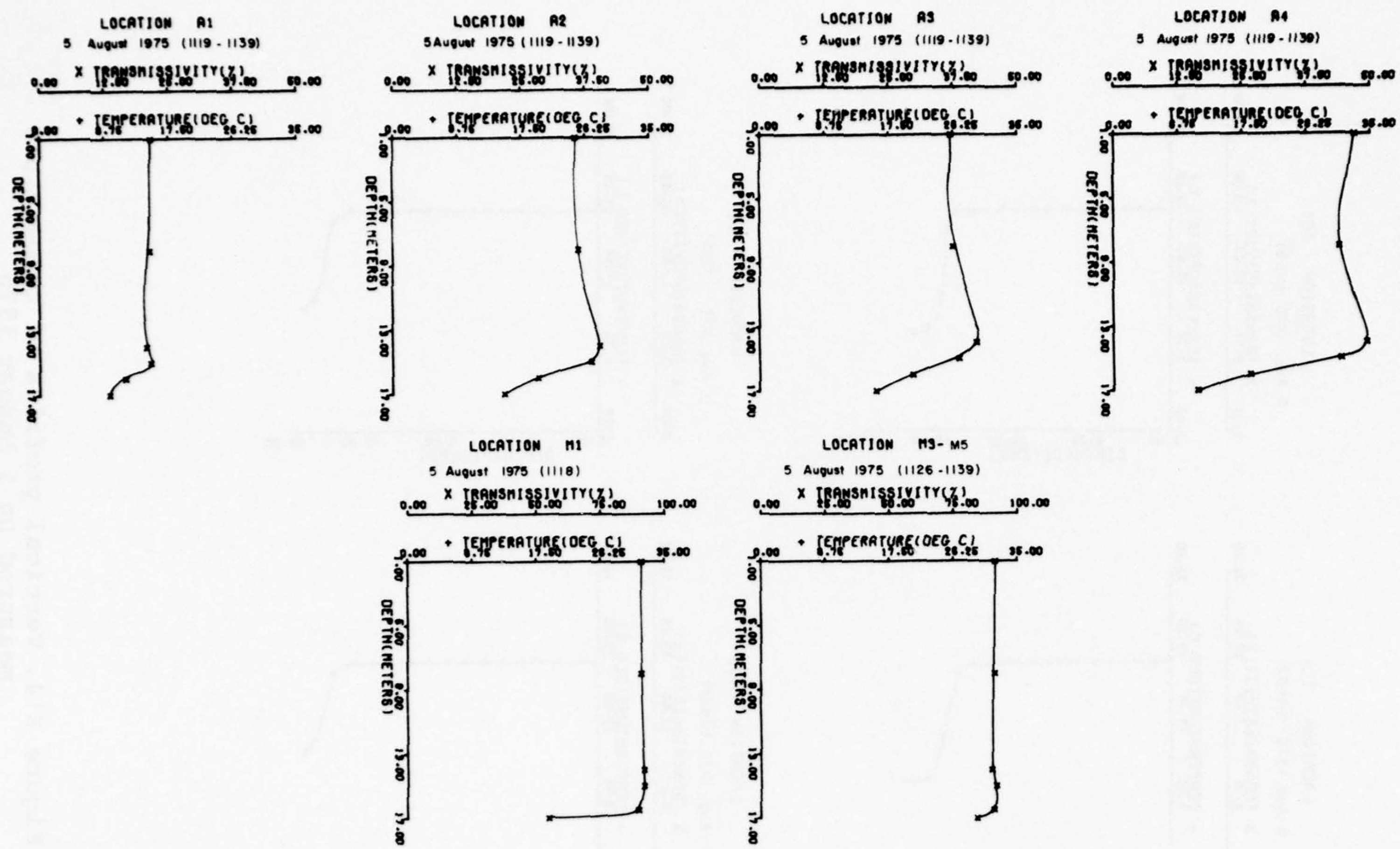


Figure K'3. Vertical profiles of transmissivity measured on 5 August 1975, prior to disposal operations

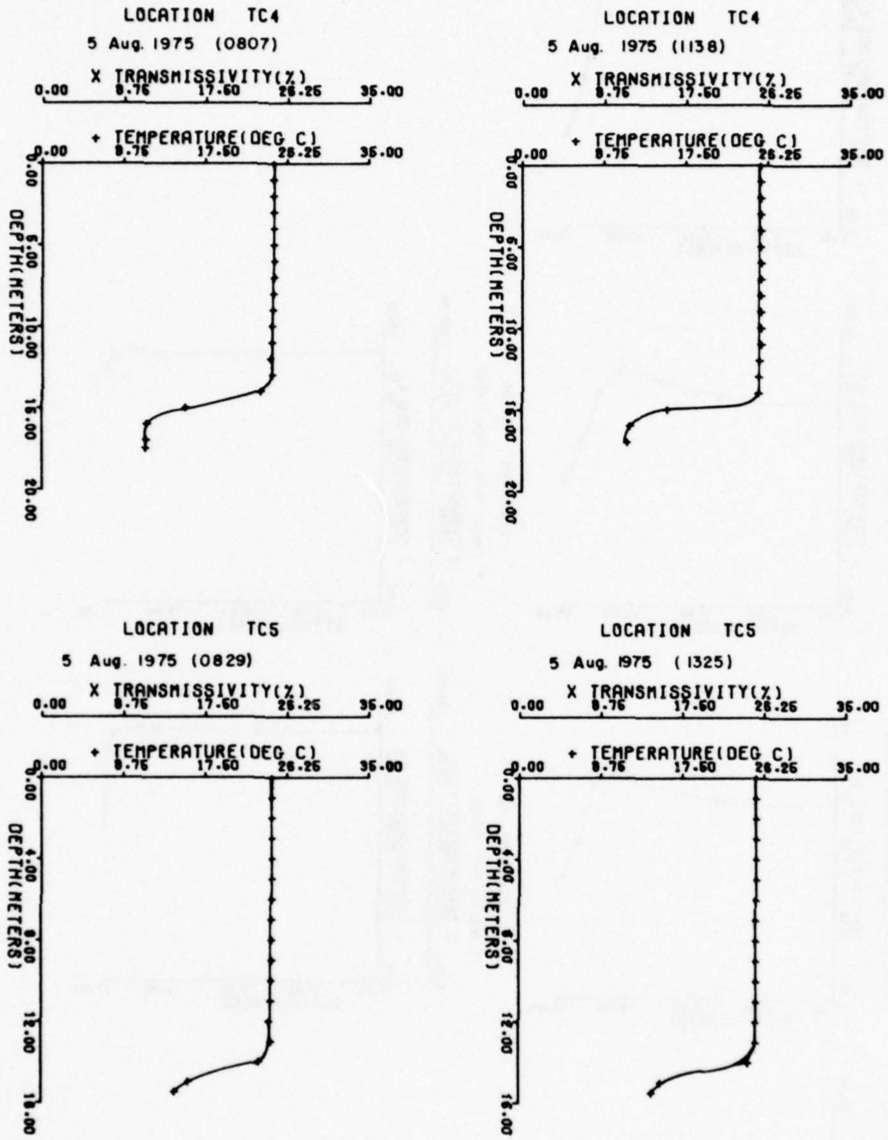


Figure K'4. Vertical profiles of temperature measured on 5 August 1975

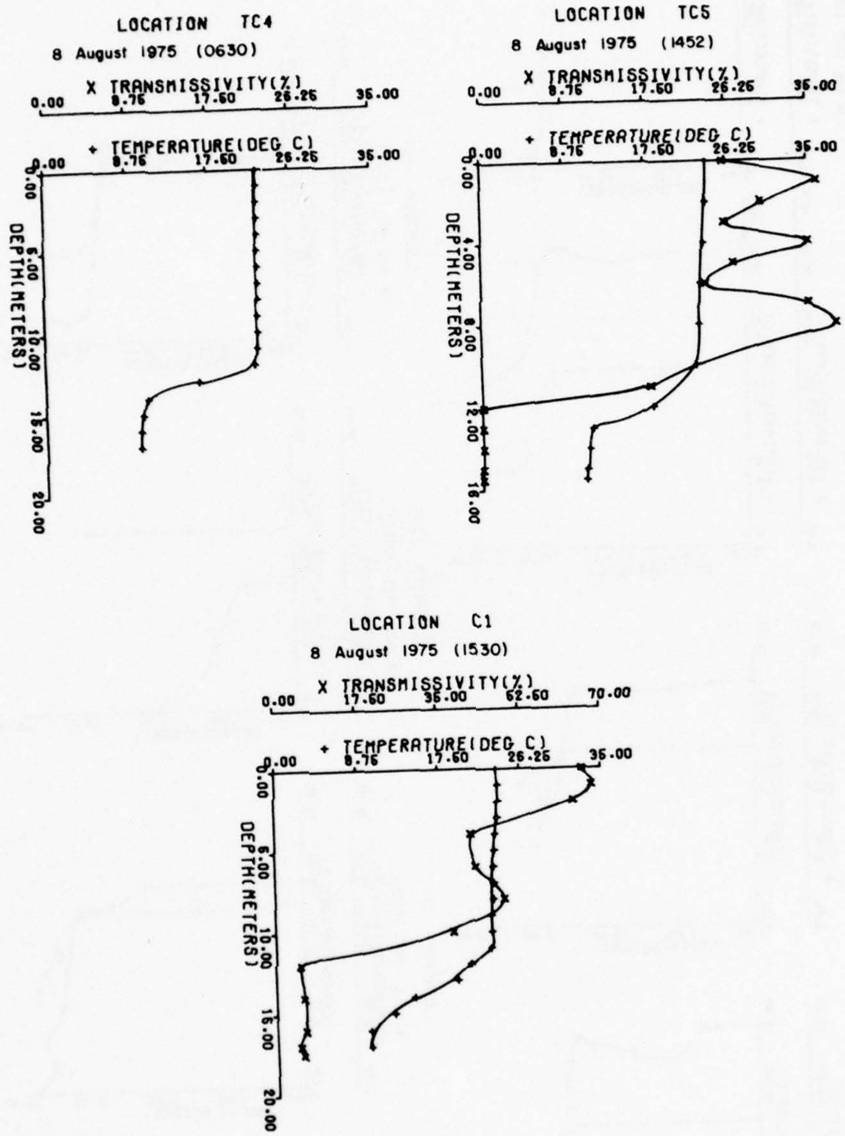


Figure K'5. Vertical profiles of temperature and transmissivity measured on 8 August 1975, prior to disposal operations

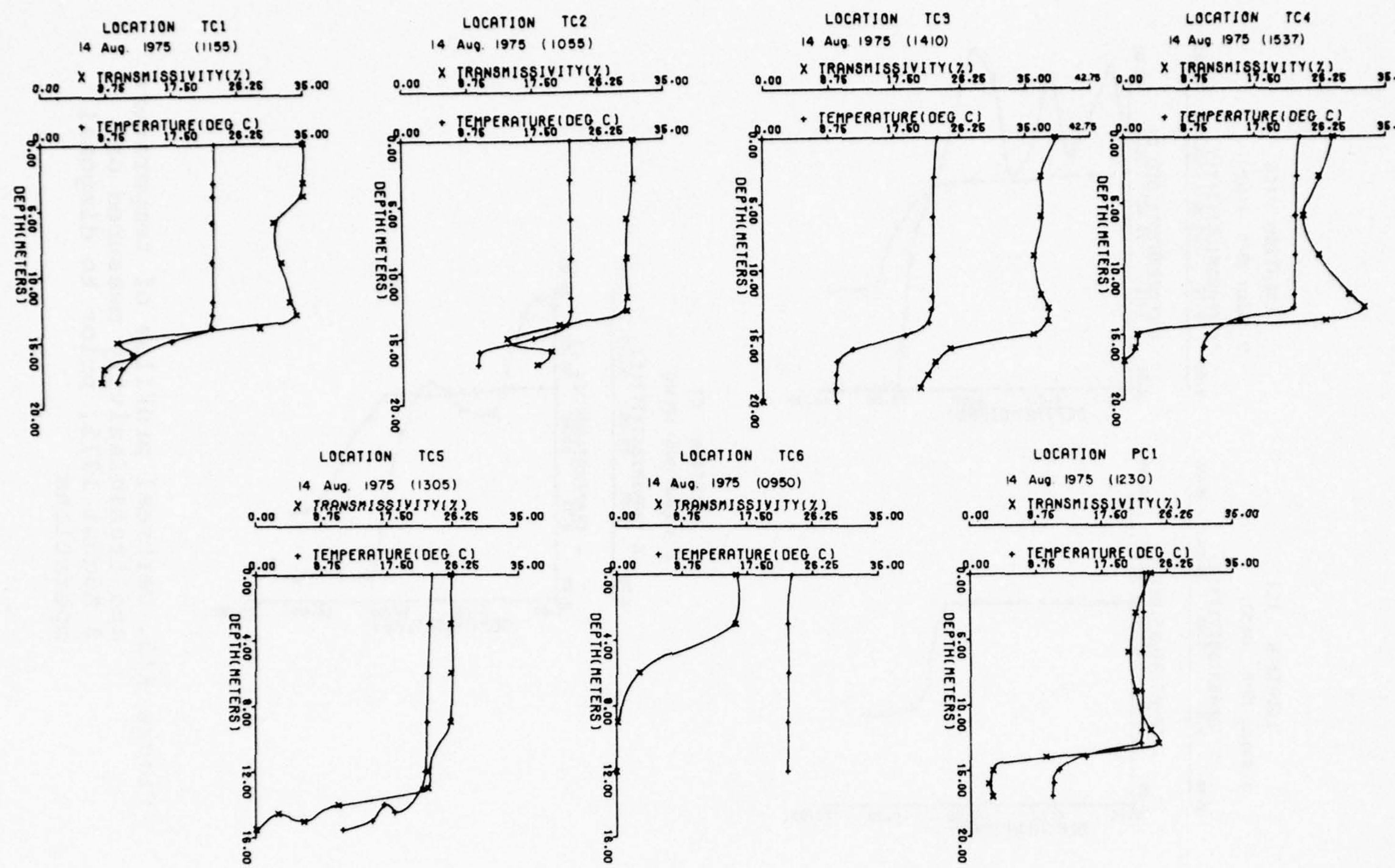


Figure K'6. Vertical profiles of temperature and transmissivity measured on 14 August 1975

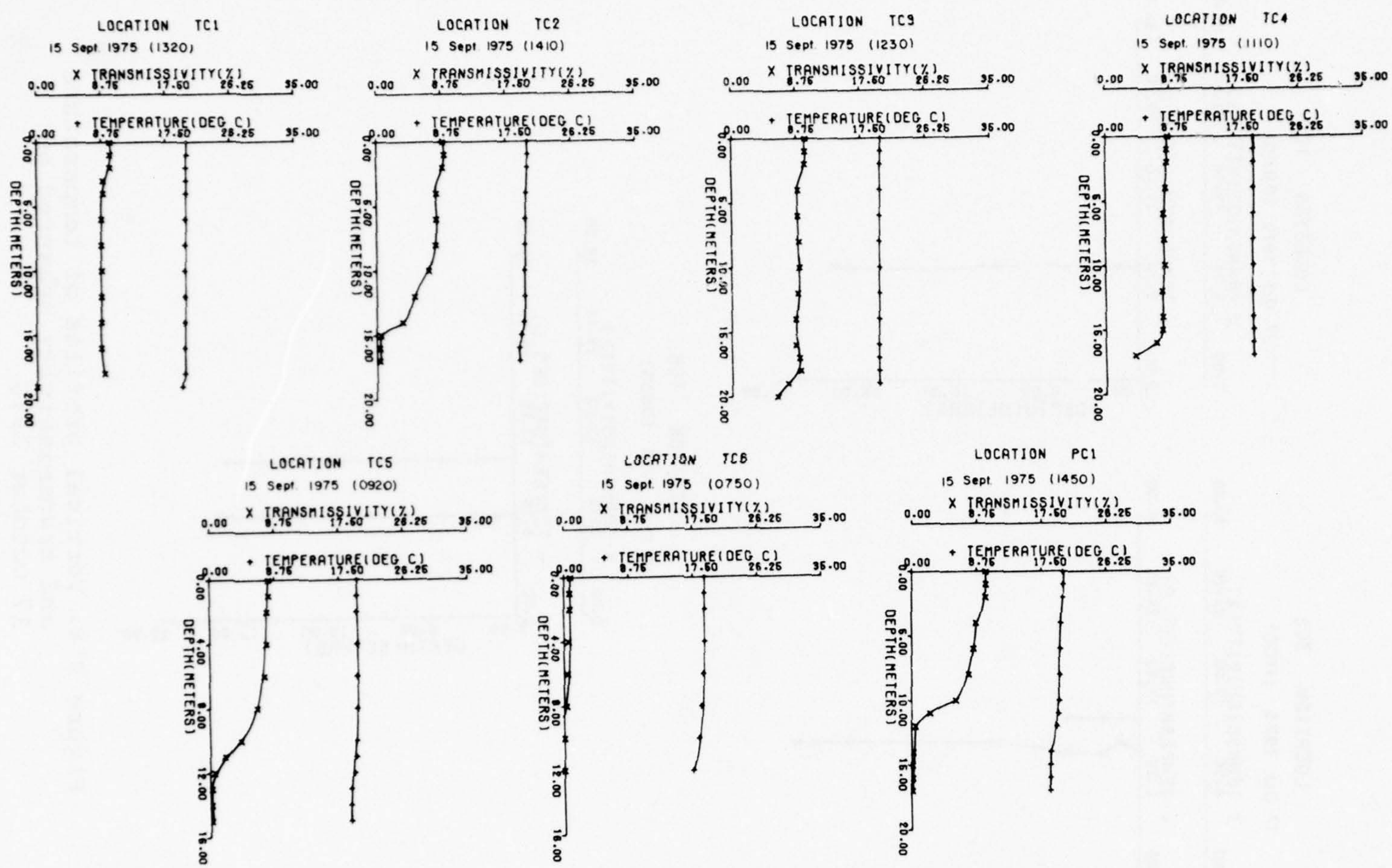
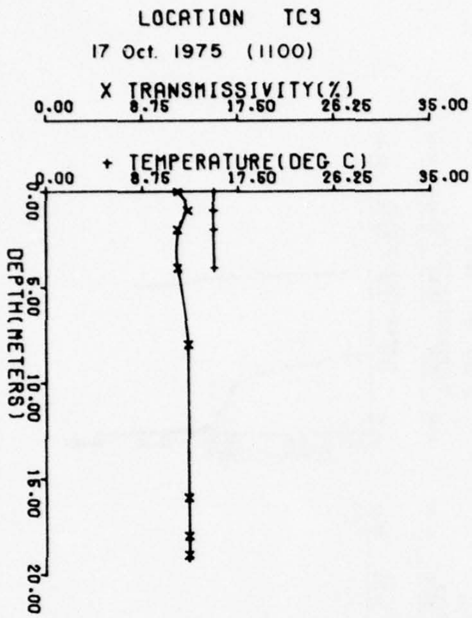
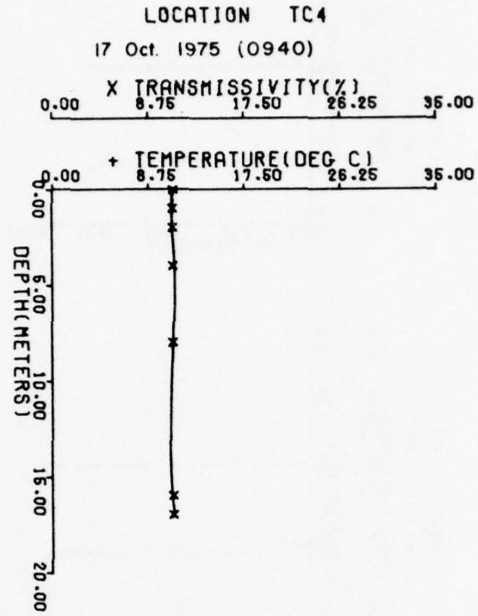


Figure K'7. Vertical profiles of temperature and transmissivity measured on 14 September 1975





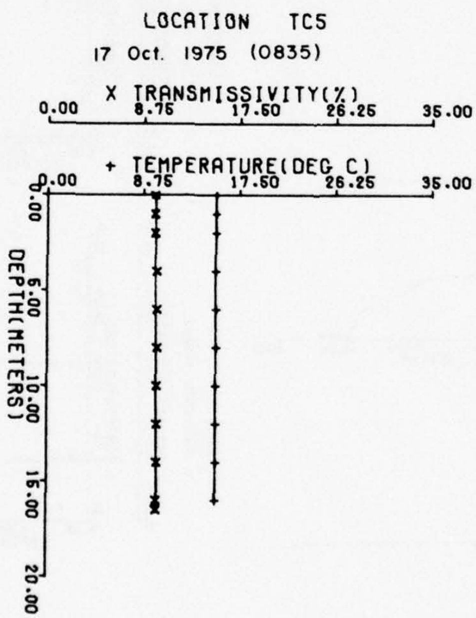


Figure K'8. Vertical profiles of temperature and transmissivity measured on 17 October 1975

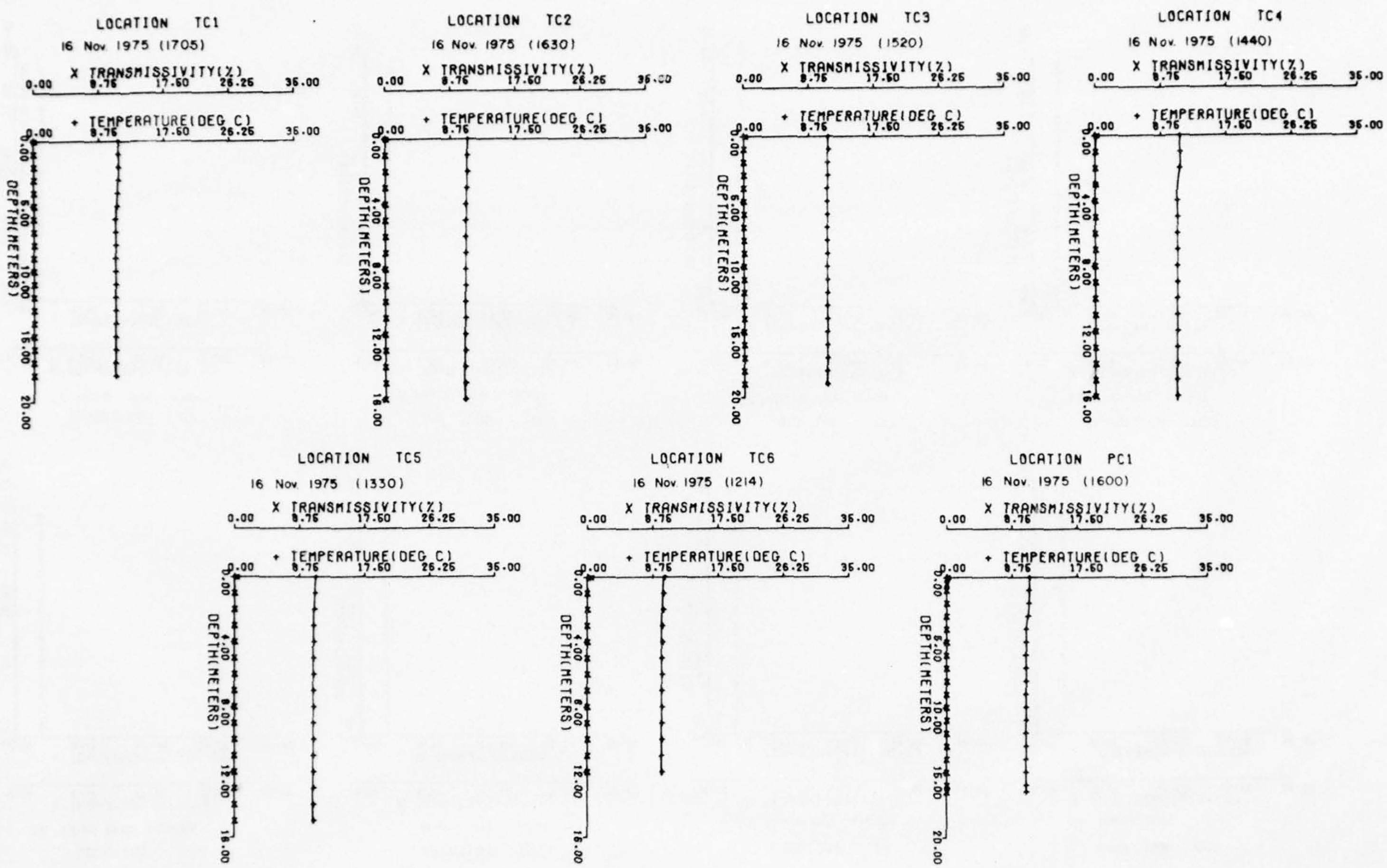


Figure K'9. Vertical profiles of temperature and transmissivity measured on 16 November 1975

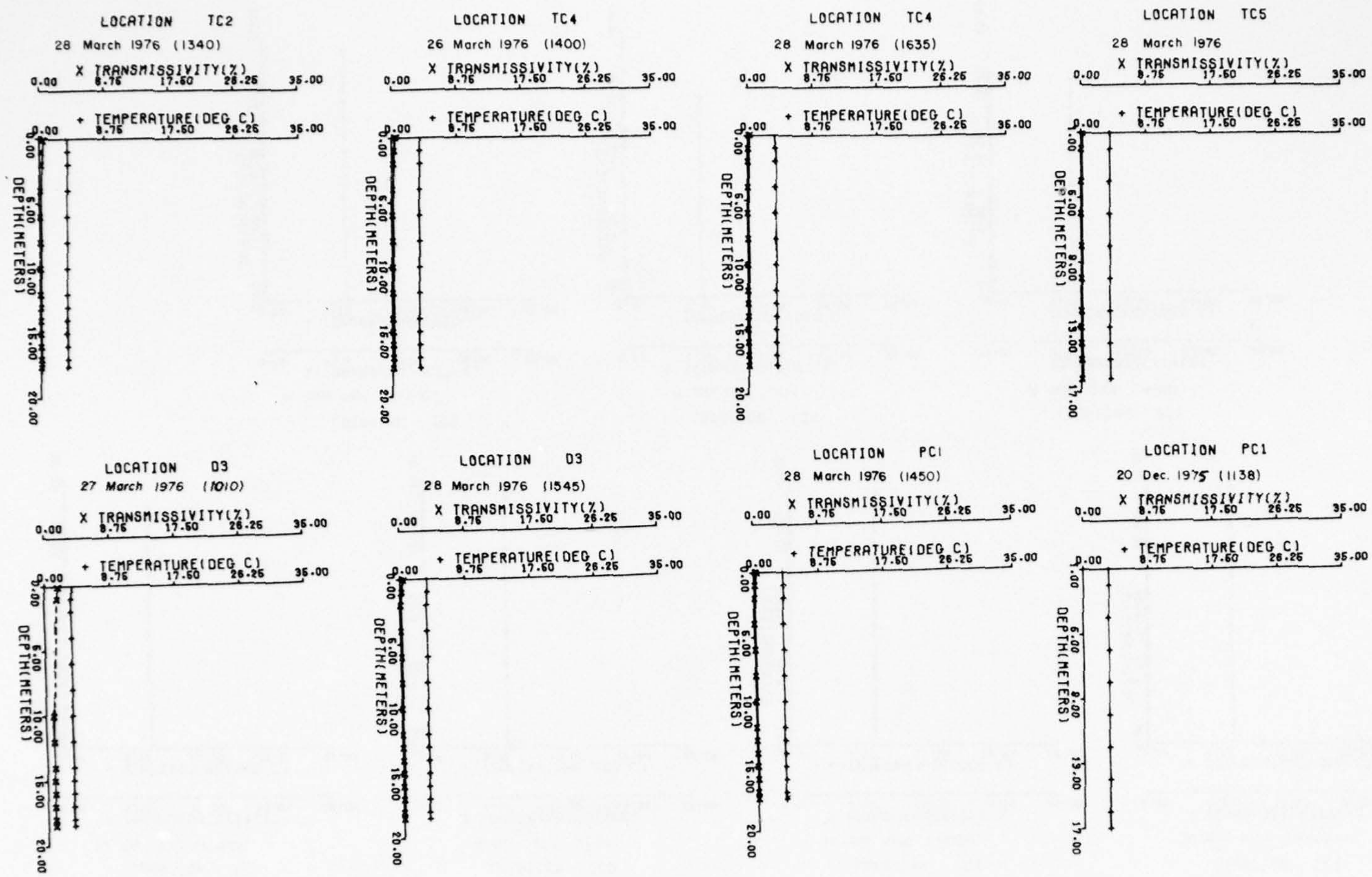


Figure K'10. Vertical profiles of temperature and transmissivity measured on 20 December 1975 and 26,27, and 28 March 1976

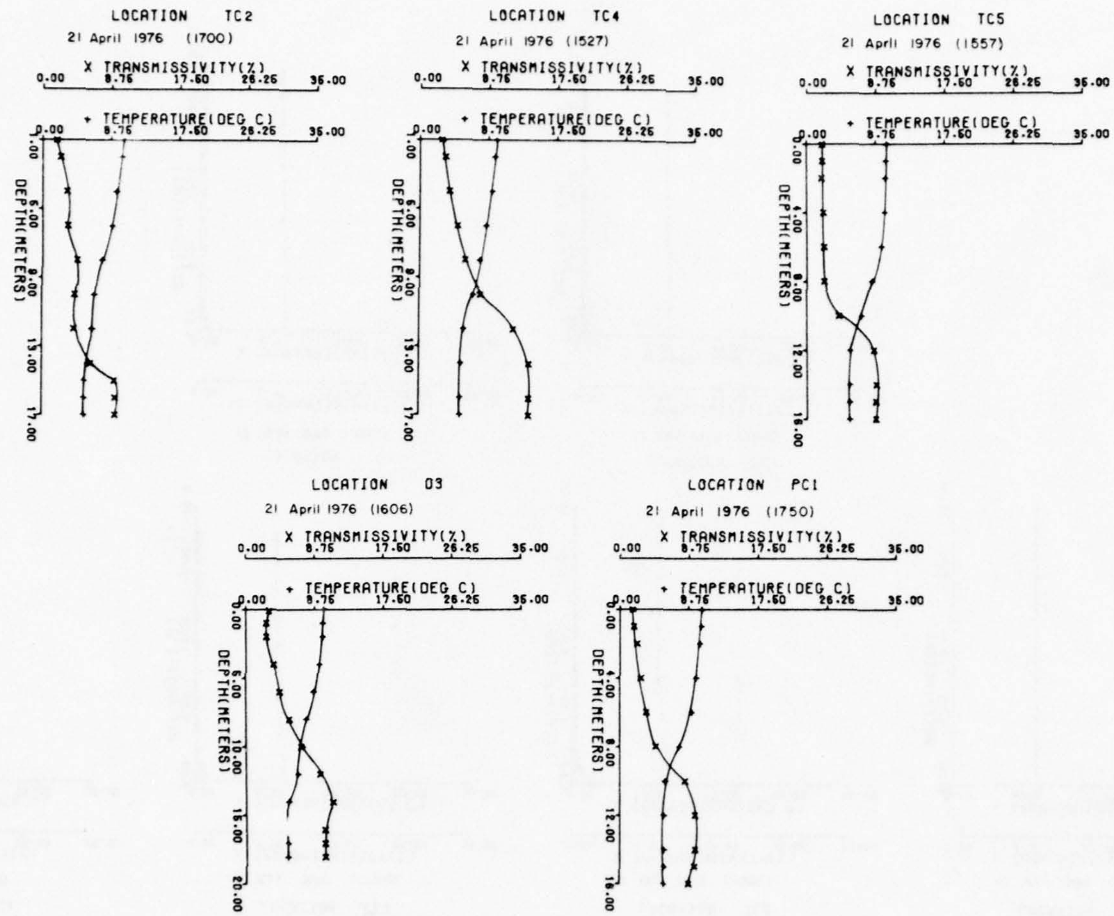


Figure K'11. Vertical profiles of temperature and transmissivity measured on 21 April 1976

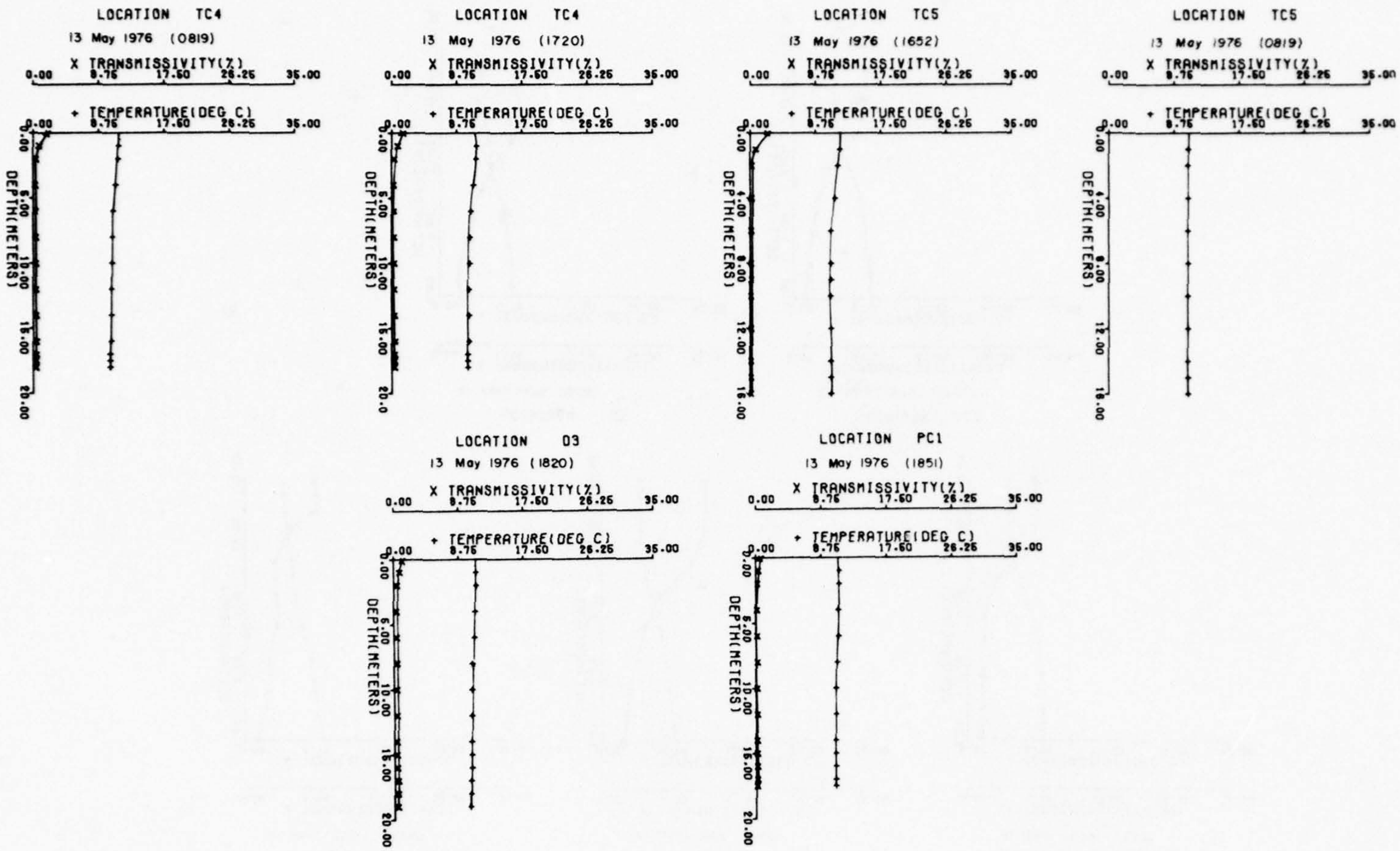


Figure K'12. Vertical profiles of temperature and transmissivity measured on 13 May 1976

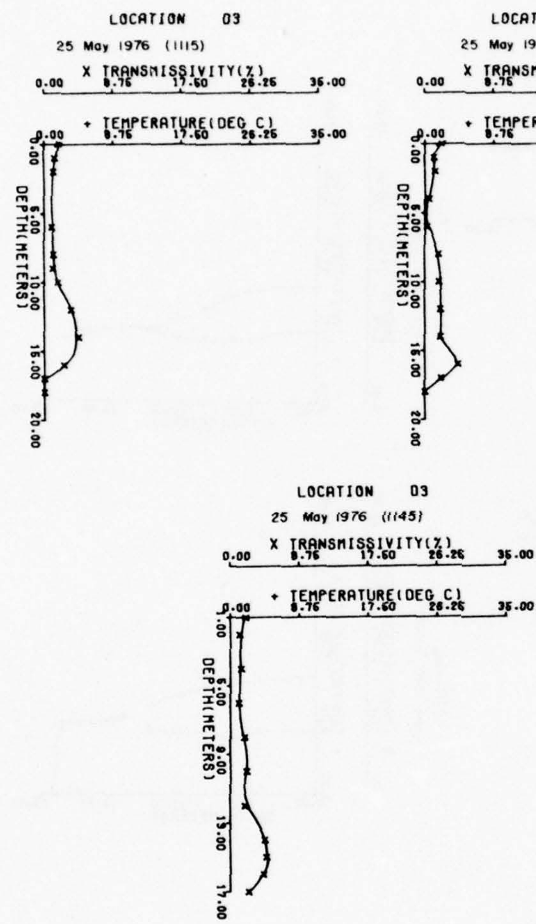


Figure K'13. Vertical profiles of transmissivity measured on 25 May 1976, prior to disposal operations

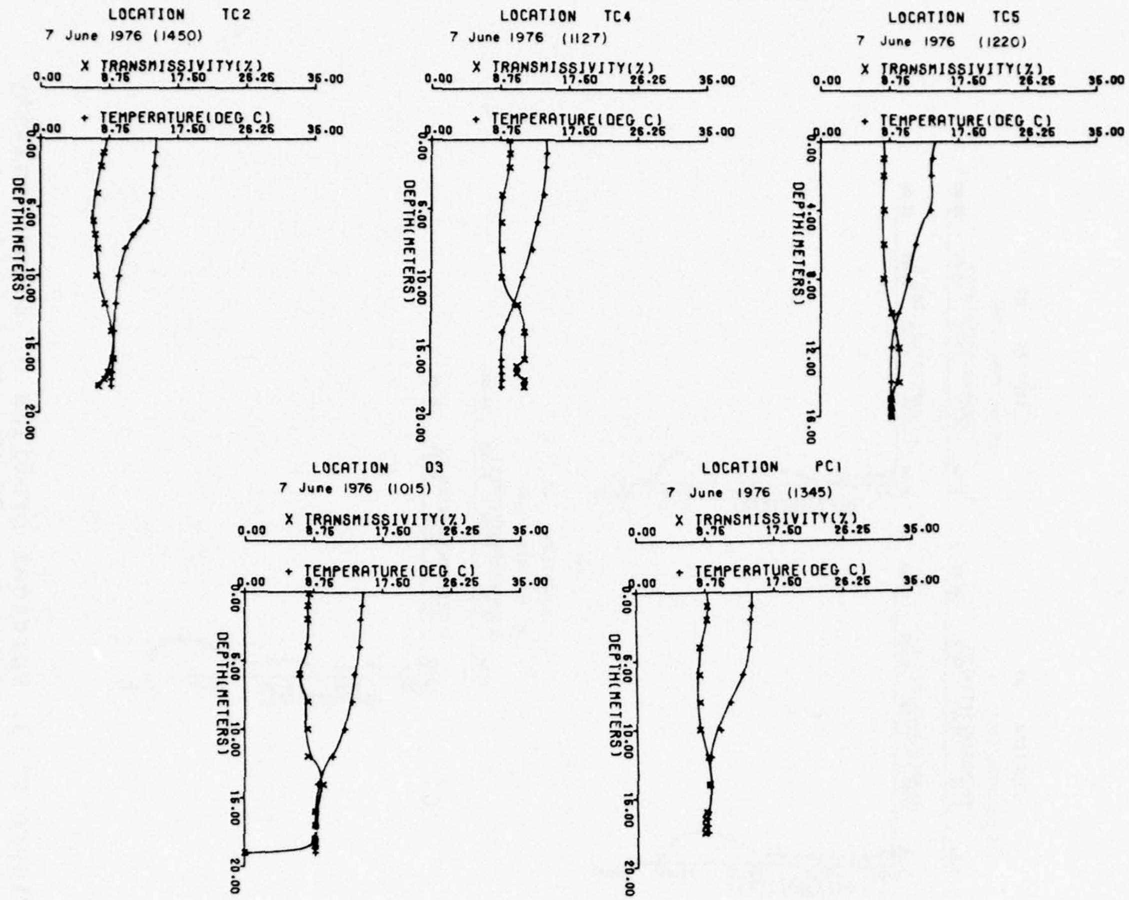


Figure K'14. Vertical profiles of temperature and transmissivity measured on 7 June 1975

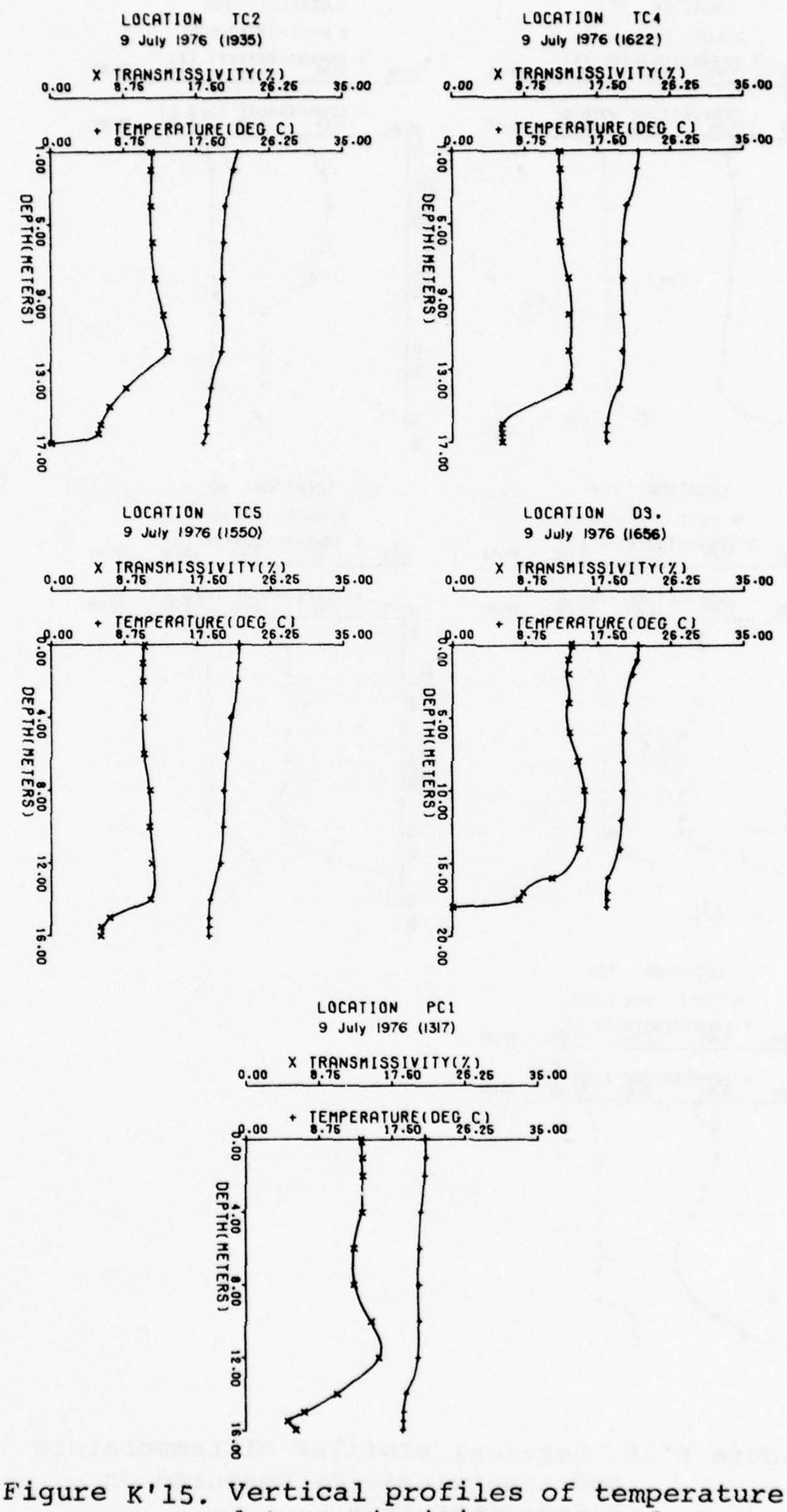


Figure K'15. Vertical profiles of temperature and transmissivity measured on 9 July 1976

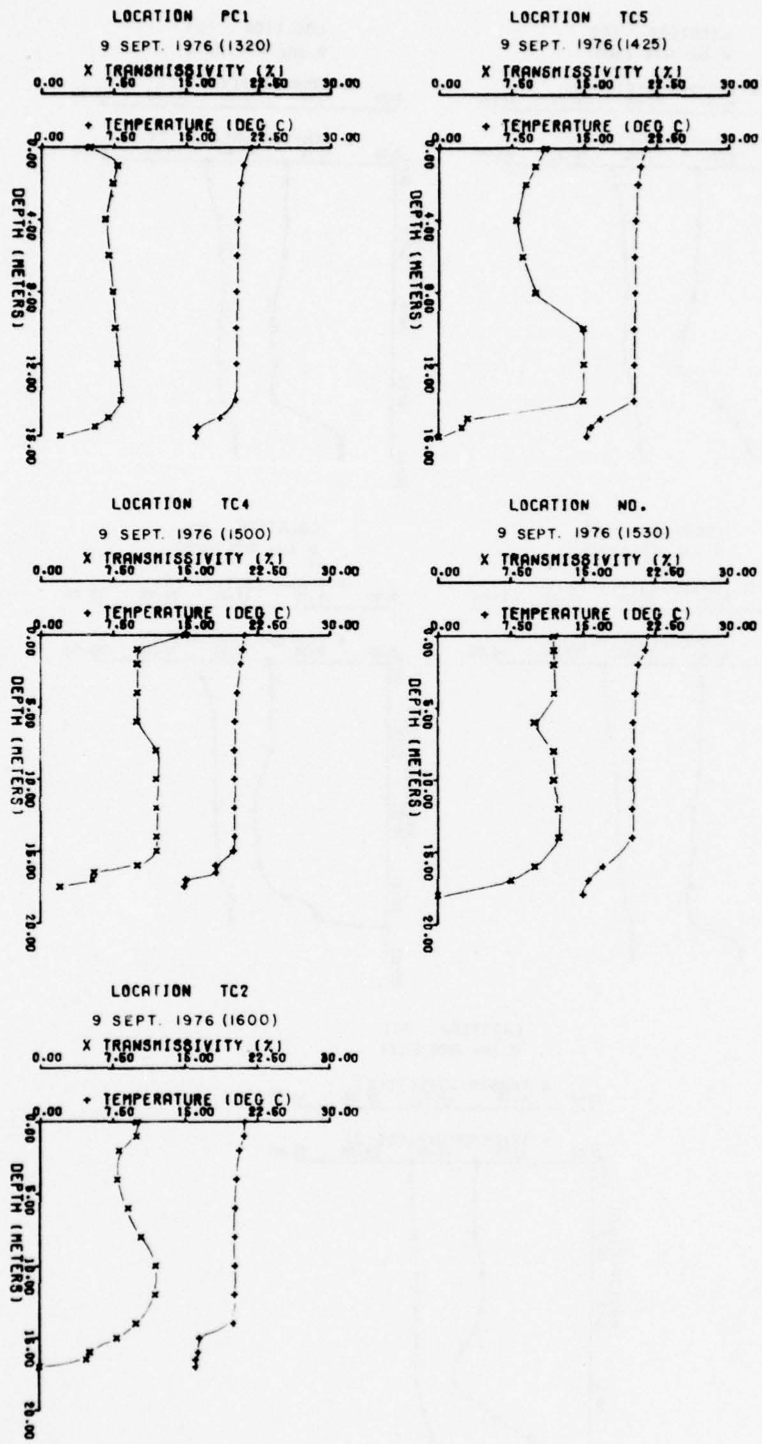


Figure K'16. Vertical profiles of temperature and transmissivity measured on 9 September 1976

APPENDIX L': SIGNIFICANT WAVE HEIGHT TABLES

Table L'1

Wave Data* for 16 August to 25 August 1975

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
16 Aug	08	0.02	5.9	0.03	0.0	4.4	20 Aug	20	0.03	4.7	0.06	0.0	2.2
	12	0.03	5.6	0.06	0.1	2.6	21 Aug	00	0.02	5.4	0.03	0.0	2.2
	16	0.01	6.4	0.02	0.0	0.8		04	0.03	4.7	0.03	0.0	3.5
	20	0.04	4.4	0.04	0.0	1.3		08					4.0
17 Aug	00	0.03	5.0	0.04	0.0	2.6		12	0.01	5.8	0.02	0.0	2.2
	04	0.01	5.6	0.02	0.0	2.6		16	0.02	6.9	0.07	0.1	5.3
	08	0.01	5.6	0.01	0.0	5.8		20	0.05	5.9	0.07	0.2	2.2
	12	0.02	4.8	0.04	0.0	5.8	22 Aug	00	0.17	5.4	0.25	0.3	4.4
	16	0.24	4.6	0.37	0.1	2.6		04	0.46	5.6	0.83	1.3	4.0
	20	0.38	4.8	0.64	0.2	2.6		08	0.50	5.5	0.75	1.1	3.5
18 Aug	00	0.22	4.7	0.36	0.1	5.8		12	0.40	5.3	0.73	0.7	1.3
	04	0.30	4.7	0.42	0.1	2.2		16	0.12	5.0	0.17	0.1	0.4
	08	0.38	4.8	0.59	0.2	2.6		20	0.05	5.0	0.09	0.0	3.5
	12	0.19	4.5	0.23	0.0	2.6	23 Aug	00	0.03	5.0	0.04	0.0	2.2
	16	0.03	5.2	0.03	0.0	2.2		04	0.30	4.7	0.46	0.1	2.6
	20	0.01	5.8	0.02	0.0	2.2		08	0.04	6.1	0.07	0.1	2.6
19 Aug	00	0.02	5.2	0.03	0.0	2.2		12	0.02	6.4	0.02	0.1	2.2
	04	0.04	5.4	0.09	0.0	2.2		16	0.02	6.3	0.04	0.1	2.2
	08	0.02	6.0	0.03	0.0	2.6		20	0.09	5.1	0.16	0.1	4.0
	12	0.02	6.2	0.02	0.0	3.5	24 Aug	00	0.01	6.5	0.01	0.1	4.0
	16	0.01	6.1	0.02	0.0	1.3		04	0.03	5.4	0.03	0.0	4.0
	20	0.03	4.7	0.03	0.0	4.9		08	0.24	4.7	0.31	0.1	3.5
20 Aug	00	0.02	5.2	0.03	0.0	4.0		12	0.43	5.4	0.70	0.9	1.7
	04	0.05	5.5	0.07	0.1	3.5		16	0.47	5.0	1.01	0.5	3.1
	08	0.26	4.4	0.37	0.0	3.1		20	0.35	4.7	0.63	0.1	3.1
	12	0.20	4.6	0.28	0.0	4.4	25 Aug	00	0.15	5.2	0.25	0.2	4.0
	16	0.04	5.1	0.06	0.0	1.7		04	0.04	5.9	0.05	0.1	3.1

* The results give the significant wave height ($H_{1/3}$), the period of the significant waves, the maximum wave (H max), the wind speed, and an estimate of the orbital velocity (O.V.) near the bottom at the disposal site.

Table L'2

Wave Data for 11 September to 26 September 1975

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
11 Sep	20	0.28	5.3	0.45	0.5	4.0	19 Sep	08	0.02	7.2	0.06	0.2	1.7
12 Sep	00	0.33	5.2	0.42	0.4	9.3		12	0.03	5.8	0.09	0.1	4.0
	04	1.38	5.3	2.39	2.4	9.6		16	0.01	8.2	0.01	0.1	2.6
	08	0.97	5.7	1.50	2.9	6.2		20	0.02	6.6	0.03	0.1	1.7
	12	0.96	5.4	1.99	1.8	6.2	20 Sep	00	0.04	5.3	0.06	0.0	4.0
	16	0.79	5.4	1.28	1.5	5.8		04	0.01	7.0	0.02	0.1	1.7
	20	0.96	4.8	1.46	0.7	5.3		08	0.10	5.1	0.19	0.1	4.0
13 Sep	00	1.02	5.0	1.56	1.1	6.7		12	0.53	4.7	0.73	0.3	4.4
	04	1.18	5.7	1.68	3.6	5.8		16	0.25	4.6	0.40	0.1	4.9
	08	0.81	5.6	1.34	2.0	7.1		20	0.38	4.7	0.53	0.2	1.7
	12	0.97	5.4	1.41	2.0	6.2	21 Sep	00	0.15	4.8	0.23	0.1	4.4
	16	1.35	6.2	1.72	6.3	9.8		04	0.91	5.2	1.33	1.3	3.5
	20	1.15	6.1	1.54	5.1	6.7		08	0.71	5.7	1.18	2.0	4.4
14 Sep	00	1.02	5.4	1.97	2.1	6.2		12	0.56	6.1	0.94	2.4	5.8
	04	0.62	4.9	0.91	0.5	4.0		16	1.00	5.9	1.54	3.8	3.5
	08	0.29	4.8	0.46	0.2	2.2		20	1.16	6.5	1.83	7.1	3.5
	12	0.22	4.6	0.30	0.1	3.1	22 Sep	00	1.27	6.4	1.92	6.8	4.0
	16	0.04	5.6	0.11	0.1	2.6		04	1.38	6.2	2.02	6.8	4.0
	20	0.03	5.4	0.04	0.0	1.3		08	0.77	6.0	1.02	3.2	3.5
15 Sep	00	0.02	5.6	0.05	0.0	2.2		12	0.60	5.4	0.91	1.3	3.5
	04	0.01	5.4	0.03	0.0	3.5		16	0.63	5.2	0.80	0.9	4.0
	08	0.01	6.1	0.02	0.0	3.1		20	0.51	5.2	0.84	0.7	2.2
	12	0.01	8.4	0.01	0.1	4.0	23 Sep	00	0.28	5.0	0.77	0.2	2.2
	16	0.01	7.8	0.02	0.1	3.1		04	0.35	4.7	0.54	0.2	2.2
	20	0.02	5.8	0.03	0.0	1.7		08	0.18	4.9	0.28	0.1	2.2
16 Sep	00	0.02	5.8	0.09	0.0	3.1		12	0.15	4.8	0.24	0.1	2.2
	04	0.02	6.2	0.09	0.1	2.6		16	0.03	5.8	0.04	0.1	1.7
	08	0.04	5.5	0.14	0.1	2.6		16	0.03	5.8	0.04	0.1	1.7
	12	0.05	5.4	0.14	0.1	3.5		20	0.02	6.2	0.08	0.1	1.7
	16	0.26	4.8	0.51	0.1	3.1	24 Sep	00	0.01	5.9	0.02	0.0	2.6
	20	0.23	4.7	0.53	0.1	1.7		04	0.30	4.5	0.44	0.0	5.3
17 Sep	00	0.03	5.4	0.06	0.0	1.7		08	1.70	5.9	2.30	6.2	5.3
	04	0.01	6.0	0.02	0.0	1.7		12	1.34	6.0	2.22	5.5	5.3
	08	0.03	4.9	0.05	0.0	1.7		16	1.46	6.0	1.98	6.0	8.0
	12	0.02	4.9	0.05	0.0	2.6		20	1.46	6.5	2.01	9.0	7.6
	16	0.09	4.0	0.09	0.0	3.5	25 Sep	00	1.58	6.5	2.07	9.4	7.6
	20	0.18	4.1	0.30	0.0	3.5		04	1.66	6.7	2.16	11.0	6.7
18 Sep	00	0.18	4.6	0.26	0.0	2.2		08	1.64	6.6	2.24	10.6	5.8
	04	0.07	5.0	0.13	0.0	4.0		12	1.21	6.6	1.78	7.6	5.3
	08	0.02	6.6	0.06	0.1	4.0		16	0.90	6.3	1.43	4.6	3.1
	12	0.04	5.9	0.10	0.1	4.9		20	0.70	5.8	0.96	2.3	3.1
	16	0.05	5.7	0.08	0.1	7.6	26 Sep	00	0.49	5.3	0.67	0.8	2.2
	20	0.03	6.8	0.04	0.2	6.7		04	0.13	5.2	0.18	0.2	2.2
19 Sep	00	0.03	8.0	0.04	0.3	4.4		08	0.09	5.1	0.13	0.1	3.1
	04	0.03	7.2	0.04	0.2	1.7		12	0.18	4.6	0.28	0.0	4.0

Table L'3

Wave Data for 16 October to 30 October 1975

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
16 Oct	16	0.23	4.3	0.36	0.2	2.6	23 Oct	16	0.02	7.0	0.03	0.2	3.1
	20	0.13	4.1	0.21	0.0	2.2		20	0.01	5.7	0.01	0.0	2.6
17 Oct	00	0.03	4.4	0.06	0.0	1.7	24 Oct	00	0.01	5.3	0.01	0.0	2.6
	04	0.30	4.2	0.43	0.2	4.0		04	0.01	5.2	0.05	0.0	3.5
	08	0.34	4.4	0.77	0.3	3.1		08	0.01	5.1	0.02	0.0	5.3
	12	0.60	4.7	0.95	1.1	5.3		12	0.01	6.2	0.01	0.0	4.4
	16	0.89	5.5	1.62	3.9	5.8		16	0.01	6.2	0.01	0.0	4.0
	20	1.14	6.3	1.78	8.1	8.9		20	0.02	4.8	0.04	0.0	3.5
18 Oct	00	1.24	7.4	1.68	12.6	10.2	25 Oct	00	0.01	5.7	0.01	0.0	6.2
	04	1.41	7.4	1.66	14.3	9.3		04	0.01	6.5	0.01	0.1	6.7
	08	1.31	6.9	1.63	11.7	7.6		08	0.10	6.4	0.57	0.7	6.2
	12	1.39	7.1	2.13	13.2	5.8		12	0.56	4.2	1.02	0.4	7.1
	16	1.31	6.7	1.93	10.9	6.2		16	0.79	5.4	1.17	3.2	6.7
	20	0.90	6.1	1.33	5.7	5.8		20	0.70	5.3	1.06	2.5	4.4
19 Oct	00	0.98	6.7	1.51	8.3	4.0	26 Oct	00	0.40	4.7	0.56	0.7	4.4
	04	0.75	6.1	0.98	4.8	2.6		04	0.35	4.5	0.55	0.4	3.1
	08	0.61	5.7	0.93	3.1	1.7		08	0.37	4.5	0.51	0.4	1.3
	12	0.03	5.2	0.52	1.1	3.1		12	0.24	4.0	0.35	0.1	1.7
	16	0.25	4.9	0.41	0.5	2.6		16	0.10	4.0	0.19	0.0	2.2
	20	0.20	4.6	0.30	0.3	1.7		20	0.04	4.6	0.07	0.0	2.2
20 Oct	00	0.09	4.4	0.16	0.1	1.7	27 Oct	00	0.06	4.6	0.08	0.0	2.6
	04	0.18	4.0	0.28	0.0	2.6		04	0.04	4.6	0.07	0.0	4.0
	08	0.27	4.4	0.48	0.3	2.2		08	0.01	5.7	0.01	0.0	2.6
	12	0.18	4.4	0.31	0.1	4.0		12	0.04	4.1	0.07	0.0	3.1
	16	0.51	4.7	0.70	0.9	4.9		16	0.00	6.5	0.00	0.0	1.7
	20	0.50	5.1	1.14	1.4	4.9		20	0.01	5.4	0.02	0.0	2.6
21 Oct	00	0.46	5.0	0.74	1.2	5.3	28 Oct	00	0.03	4.5	0.06	0.0	2.2
	04	1.02	6.0	1.52	6.1	5.3		04	0.03	4.8	0.05	0.0	3.5
	08	0.79	6.4	1.31	5.7	4.9		08	0.01	5.3	0.01	0.0	3.5
	12	0.71	5.6	1.02	3.4	5.3		12	0.06	4.3	0.09	0.0	3.5
	16	0.49	5.5	0.75	2.0	3.1		16	0.43	4.1	0.67	0.2	7.1
	20	0.26	5.0	0.35	0.7	1.7		20	0.78	5.7	1.34	4.0	2.6
22 Oct	00	0.21	4.2	0.36	0.1	1.7	29 Oct	00	0.36	4.9	0.52	0.8	2.2
	04	0.28	4.1	0.45	0.1	4.0		04	0.36	4.5	0.54	0.4	7.6
	08	0.19	4.1	0.31	0.1	0.8		08	0.90	5.0	1.41	2.3	6.2
	12	0.06	4.4	0.09	0.0	3.5		12	0.70	4.9	1.29	1.7	6.7
	16	0.03	4.4	0.03	0.0	4.0		16	0.68	4.3	1.53	0.6	8.4
	20	0.02	4.8	0.03	0.0	2.2		20	0.81	5.0	1.37	2.2	8.0
23 Oct	00	0.10	3.8	0.15	0.0	3.1	30 Oct	00	0.90	5.1	1.34	2.6	8.4
	04	0.08	4.2	1.24	0.0	3.5		04	1.16	5.2	1.53	3.8	7.6
	08	0.01	5.2	0.03	0.0	3.5		08	0.67	4.6	1.12	1.1	8.9
	12	0.01	5.6	0.03	0.0	4.0							

Table L'4

Wave Data for 11 November to 2 December 1975

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
11 Nov	16	0.07	4.3	0.12	0.0	2.2	20 Nov	00	0.02	4.8	0.03	0.0	3.1
	20	0.02	4.7	0.03	0.0	2.6		04	0.04	4.4	0.06	0.0	3.5
12 Nov	00	0.02	5.3	0.03	0.0	2.2		08	0.01	5.9	0.02	0.1	4.4
	04	0.01	7.5	0.01	0.1	4.4		12	0.01	6.6	0.02	0.1	5.3
	08	0.05	4.9	0.07	0.1	3.5		16	0.02	6.2	0.02	0.1	6.2
	12	0.18	4.7	0.30	0.3	2.6		20	0.01	6.9	0.02	0.1	5.3
	16	0.52	5.2	0.73	1.7	5.3	21 Nov	00	0.88	4.8	1.23	1.8	8.0
	20	1.37	6.0	1.79	8.3	9.8		04	0.80	6.4	1.24	6.0	3.1
13 Nov	00	0.87	6.1	1.18	5.7	5.3		08	0.54	5.7	0.80	2.6	5.3
	04	0.62	5.6	0.97	2.9	4.4		12	0.78	6.1	1.23	5.1	6.2
	08	0.54	5.8	0.83	2.8	3.1		16	1.05	6.5	1.46	8.1	5.3
	12	0.35	5.2	0.53	1.2	3.1		20	1.11	6.7	1.53	9.3	4.4
	16	0.28	4.7	0.56	0.4	4.0	22 Nov	00	1.33	6.0	1.84	8.2	9.8
	20	1.46	6.1	1.79	9.4	9.8		04	1.35	5.7	1.84	6.9	8.0
14 Nov	00	1.59	6.3	1.99	11.1	11.1		08	0.92	5.6	1.73	4.2	4.9
	04	1.64	6.2	2.11	11.2	12.5		12	0.66	4.7	1.01	1.2	6.2
	08	1.52	6.0	2.13	9.4	11.1		16	0.68	4.4	1.05	0.7	4.9
	12	1.59	6.1	2.30	10.0	9.8		20	0.45	4.8	0.78	0.9	4.4
	16	1.94	6.2	2.36	12.9	9.3	23 Nov	00	0.47	4.8	0.62	1.0	2.6
	20	1.39	6.2	2.18	9.2	8.0		04	0.50	4.9	0.90	1.2	3.5
15 Nov	00	0.79	5.0	1.31	2.1	6.2		08	0.38	4.5	0.65	0.4	3.1
	04	0.56	5.0	0.73	1.4	4.0		12	0.31	4.1	0.55	0.1	5.8
	08	0.62	5.4	0.98	2.5	5.3		16	0.19	3.9	0.24	0.0	2.2
	12	0.69	6.1	1.09	4.3	6.2		20	0.06	4.0	0.11	0.0	2.6
	16	0.67	6.0	0.96	4.0	4.9	24 Nov	00	0.03	4.6	0.04	0.0	2.6
	20	0.89	6.5	1.56	6.8	4.0		04	0.02	4.8	0.02	0.0	2.6
16 Nov	00	1.44	6.6	1.68	11.6	5.8		08	0.02	4.8	0.04	0.0	2.2
	04	0.89	5.9	1.46	5.2	4.9		12	0.02	4.8	0.04	0.0	2.6
	08	0.51	5.3	0.77	1.9	1.7		16	0.26	3.7	0.40	0.0	4.4
	12	0.28	4.5	0.41	0.3	2.6		20	0.25	4.2	0.60	0.2	4.9
	16	0.14	4.3	0.25	0.1	0.8	25 Nov	00	0.25	4.4	0.37	0.2	2.2
	20	0.05	4.5	0.08	0.0	3.1		04	0.19	4.6	0.27	0.2	2.2
17 Nov	00	0.02	5.3	0.02	0.0	3.5		08	0.21	4.6	0.41	0.3	4.0
	04	0.03	5.3	0.05	0.1	3.5		12	0.50	5.3	0.72	1.9	4.4
	08	0.23	4.6	0.38	0.3	4.0		16	0.51	5.4	0.78	2.1	4.4
	12	0.33	4.5	0.42	0.4	4.9		20	0.50	5.6	0.84	2.3	3.1
	16	0.27	4.4	0.38	0.2	2.2	26 Nov	00	0.28	5.0	0.39	0.7	4.0
	20	0.14	4.2	0.27	0.1	3.5		04	0.25	4.8	0.55	0.5	3.1
18 Nov	00	0.11	4.0	0.17	0.0	3.1		08	0.23	4.7	0.36	0.4	4.4
	04	0.22	3.8	1.57	0.0	3.1		12	0.25	4.4	0.38	0.2	2.6
	08	0.27	4.0	0.43	0.1	3.1		16	0.08	4.2	0.11	0.0	3.1
	12	0.23	3.9	0.35	0.0	4.4		20	0.10	4.0	0.16	0.0	3.5
	16	0.16	4.0	0.26	0.0	1.3	27 Nov	00	0.18	4.7	0.34	0.3	5.8
	20	0.12	3.9	0.20	0.0	2.6		04	0.12	5.6	0.17	0.5	7.1
19 Nov	00	0.04	4.1	0.05	0.0	3.1		08	0.97	5.8	1.49	5.3	7.6
	04	0.02	4.4	0.03	0.0	3.1		12	1.19	7.2	1.60	11.4	6.7
	08	0.01	4.9	0.01	0.0	3.1		16	1.10	6.8	1.54	9.3	5.3
	12	0.01	6.0	0.02	0.0	2.6		20	0.88	5.9	1.32	4.9	5.8
	16	0.02	4.9	0.05	0.0	1.3	28 Nov	00	0.93	5.8	1.32	4.8	5.8
	20	0.07	4.5	0.09	0.0	2.6		04	0.97	6.0	1.38	6.0	5.3

(continued)

Table L'4 (concluded)

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
28 Nov	08	0.70	5.7	1.03	3.4	4.4	30 Nov	12	0.39	5.8	0.60	2.1	8.0
	12	0.50	5.1	0.78	1.5	4.0		16	0.33	6.1	0.51	2.0	8.4
	16	0.38	4.9	0.57	0.8	3.5		20	1.83	6.5	2.81	14.3	12.0
	20	0.20	4.6	0.38	0.3	3.1	1 Dec	00	1.87	7.6	2.21	19.9	10.2
29 Nov	00	0.11	4.1	0.14	0.0	3.1		04	1.88	7.8	2.42	21.0	10.7
	04	0.02	6.2	0.03	0.1	4.4		08	1.40	7.5	2.11	14.7	7.6
	08	0.02	7.0	0.02	0.2	4.9		12	1.60	7.1	2.31	15.4	7.6
	12	0.03	7.2	0.04	0.3	7.6		16	0.72	6.6	1.09	5.8	4.9
	16	0.04	5.8	0.09	0.2	6.2		20	0.38	5.8	0.52	2.0	4.4
	20	0.05	6.2	0.07	0.3	8.0	2 Dec	00	0.31	5.2	0.42	1.0	2.6
30 Nov	00	0.07	6.0	0.11	0.4	7.1		04	0.14	4.8	0.19	0.3	4.4
	04	0.16	5.8	0.23	0.9	8.9		08	1.15	4.9	0.24	0.3	4.4
	08	0.47	5.5	0.71	1.9	8.4							

Table L'5

Wave Data for 25 March to 20 April 1976

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
25 Mar	20	0.16	6.1	1.70	0.7	3.5
26 Mar	00	0.06	5.5	0.42	0.1	1.7
	04	0.48	5.4	2.60	1.0	3.1
	08	0.02	5.1	0.04	0.0	3.5
	12	0.04	5.9	0.09	0.1	6.2
	16	0.13	5.8	1.28	0.4	6.2
	20					3.5
27 Mar	00	0.02	6.1	0.07	0.1	5.8
	04	0.29	6.3	0.55	1.5	4.9
	08	0.44	5.3	1.87	0.8	5.8
	12	0.03	6.8	0.03	0.2	6.7
	16	0.12	5.4	0.17	0.2	11.1
	20	1.34	7.0	2.08	10.6	8.9
28 Mar	00	0.96	6.8	1.46	6.8	8.9
	04	0.50	6.3	0.74	2.7	6.7
	08	0.43	5.7	0.73	1.2	4.0
	12	0.15	5.3	0.21	0.2	3.1
	16	0.03	5.8	0.04	0.1	3.5
	20	0.01	7.1	0.01	0.0	2.6
29 Mar	00	0.02	7.0	0.06	0.1	2.2
	04	0.02	6.1	0.03	0.0	2.6
	08	0.06	5.6	0.08	0.1	1.7
	12	0.22	5.4	0.37	0.4	4.0
	16	0.14	5.7	0.23	0.4	4.4
	20	0.07	6.1	0.12	0.3	4.0
30 Mar	00	0.04	6.1	0.11	0.1	4.0
	04	0.01	6.5	0.02	0.1	6.2
	08					6.7
	12					8.4
	16					8.0
	20					6.2
31 Mar	00	0.10	5.9	0.16	0.3	5.8
	04	0.25	5.8	0.40	0.8	4.0
	08	0.19	6.1	0.28	0.8	0.8
	12	0.12	6.0	0.20	0.5	3.1
	16	0.05	5.7	0.07	0.1	2.2
	20	0.02	6.1	0.03	0.0	4.9
1 Apr	00	0.07	6.7	0.56	0.5	2.2
	04					2.2
	08	0.00	8.5	0.01	0.0	4.9
	12	0.06	5.4	0.09	0.1	6.2
	16	0.26	5.8	0.41	0.9	7.1
	20	0.45	5.9	0.80	1.7	4.9
2 Apr	00	0.58	5.7	1.13	1.7	4.9
	04	0.50	6.2	0.72	2.5	6.2
	08	0.32	5.8	0.47	1.1	5.8
	12	0.22	5.6	0.34	0.6	5.8
	16	0.24	5.3	0.39	0.4	5.8
	20	0.11	5.2	0.29	0.1	5.3
3 Apr	00	0.02	6.3	0.10	0.1	1.7
3 Apr	04	0.01	6.5	0.01	0.0	2.6
	08	0.01	6.6	0.01	0.0	2.2
	12	0.00	7.0	0.01	0.0	4.0
	16	0.00	6.5	0.00	0.0	5.3
	20	0.02	5.2	0.05	0.0	4.4
4 Apr	00	0.01	5.9	0.02	0.0	4.4
	04	0.60	6.3	1.00	3.1	7.6
	08	1.53	6.6	2.59	9.9	8.4
	12	1.11	6.5	2.02	6.8	7.1
	16	0.31	6.0	0.51	1.2	3.1
	20	0.18	5.7	0.34	0.5	8.9
5 Apr	00	0.54	6.0	0.87	2.1	4.9
	04	0.08	5.7	0.14	0.2	2.6
	08	0.02	6.3	0.03	0.1	3.5
	12	0.19	4.8	0.39	0.1	7.6
	16	0.15	5.5	0.24	0.3	6.2
	20	0.13	5.4	0.21	0.2	3.5
6 Apr	00	0.02	6.8	0.03	0.1	4.4
	04	0.01	6.8	0.03	0.1	4.0
	08					1.3
	12	0.01	6.5	0.01	0.0	3.1
	16					4.0
	20	0.01	6.1	0.02	0.0	2.2
7 Apr	00					1.7
	04					1.3
	08					1.7
	12	0.00	6.9	0.00	0.0	4.0
	16	0.01	5.8	0.02	0.0	2.2
	20	0.00	6.3	0.00	0.0	2.6
8 Apr	00	0.01	6.0	0.02	0.0	6.2
	04	0.04	5.3	0.12	0.0	4.4
	08	0.08	5.7	0.35	0.2	4.0
	12	0.02	5.9	0.04	0.0	4.9
	16	0.01	7.2	0.02	0.0	4.4
	20	0.01	7.4	0.01	0.1	5.3
9 Apr	00	0.32	5.5	0.53	0.7	6.2
	04	0.11	5.2	0.16	0.1	3.1
	08	0.08	5.8	0.40	0.2	3.5
	12	0.01	6.5	0.01	0.0	3.1
	16	0.04	6.6	0.26	0.2	3.5
	20	0.00	6.6	0.01	0.0	2.6
10 Apr	00	0.00	8.6	0.00	0.0	2.2
	04	0.03	7.1	0.14	0.2	2.6
	08	0.02	5.7	0.02	0.0	3.5
	12	0.34	4.9	0.59	0.3	8.0
	16	0.16	5.3	0.25	0.3	5.8
	20	0.07	5.9	0.10	0.2	2.2
11 Apr	00	0.04	5.6	0.06	0.1	3.1
	04					4.0
	08	0.87	6.5	1.17	5.1	9.3

(continued)

Table L'5 (concluded)

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
11 Apr	12	0.77	6.9	1.11	5.7	8.9
	16	0.76	6.7	1.21	5.2	8.9
	20	0.63	6.8	1.03	4.5	8.9
12 Apr	00	0.72	6.2	1.32	3.4	8.9
	04	0.60	5.8	0.91	1.9	8.4
	08	0.28	5.5	0.86	0.6	5.3
	12	0.35	5.2	0.81	0.5	4.0
	16	0.11	5.9	0.45	0.4	5.8
	20	0.11	6.0	0.32	0.4	2.6
13 Apr	00	0.07	6.2	0.30	0.3	2.6
	04	0.02	6.6	0.09	0.1	3.1
	08	0.10	6.2	0.24	0.4	3.1
	12	0.03	6.3	0.15	0.1	6.2
	16	0.03	5.8	0.08	0.1	6.2
	20	0.01	7.1	0.02	0.1	2.2
14 Apr	00	0.01	7.6	0.02	0.1	3.5
	04	0.01	6.9	0.01	0.1	3.5
	08	0.01	5.9	0.04	0.0	3.1
	12	0.00	7.6	0.01	0.0	4.4
	16	0.02	6.0	0.12	0.1	1.7
	20	0.02	5.0	0.04	0.0	2.2
15 Apr	00	0.00	6.4	0.00	0.0	4.0
	04	0.01	6.1	0.02	0.0	4.9
	08	0.01	5.6	0.02	0.0	5.8
	12					5.3
	16	0.01	7.8	0.02	0.1	6.7
	20	0.01	7.7	0.01	0.1	2.6

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
16 Apr	00					3.5
	04	0.03	6.3	0.05	0.2	7.6
	08					2.6
	12					7.6
	16					4.4
	20					1.3
17 Apr	00	0.01	6.7	0.02	0.0	3.1
	04	0.02	5.6	0.05	0.0	3.1
	08					3.5
	12					5.3
	16	0.19	5.0	0.29	0.2	1.3
	20					1.3
18 Apr	00					3.1
	04	0.06	4.7	0.19	0.0	3.5
	08	0.10	5.3	0.19	0.1	2.6
	12					4.0
	16	0.02	6.1	0.04	0.1	1.7
	20					1.7
19 Apr	00					3.5
	04					3.5
	08					3.1
	12					6.7
	16	0.01	6.6	0.03	0.0	4.9
	20	0.03	5.7	0.05	0.1	2.2
20 Apr	00	0.09	4.2	0.19	0.0	3.1
	04	0.06	4.2	0.06	0.0	0.8
	08					3.1

Table L'6

Wave Data for 21 April to 11 May 1976

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
21 Apr	12					1.7	30 Apr	00	0.00	7.4	0.01	0.0	5.8
	16					2.6		04	0.01	5.4	0.01	0.0	4.4
	20					3.5		08	0.00	6.8	0.00	0.0	2.6
22 Apr	00					3.5		12	0.01	5.8	0.01	0.0	3.5
	04					4.4		16	0.00	7.0	0.00	0.0	3.1
	08	0.24	4.9	0.38	0.2	6.2		20	0.01	7.4	0.05	0.1	2.2
	12	0.37	5.7	0.71	1.1	4.4	1 May	00	0.00	7.0	0.00	0.0	4.0
	16	0.48	5.5	0.90	1.0	5.8		04	0.00	6.5	0.00	0.0	4.0
	20	0.24	5.3	0.44	0.4	8.9		08	0.00	6.2	0.00	0.0	1.3
23 Apr	00	0.34	5.0	0.49	0.3	8.0		12	0.02	5.0	0.04	0.0	3.1
	04	0.22	4.9	0.36	0.2	2.2		16	0.01	6.0	0.02	0.0	3.1
	08	0.07	5.4	0.12	0.1	5.3		20					4.0
	12	0.04	5.6	0.08	0.1	4.9	2 May	00	0.01	5.7	0.01	0.0	4.4
	16	0.01	7.1	0.01	0.0	4.4		04	0.01	5.2	0.02	0.0	2.6
	20	0.01	6.4	0.01	0.0	4.0		08	0.01	5.4	0.02	0.0	3.5
24 Apr	00					2.6		12					1.7
	04					1.7		16	0.02	7.4	0.02	0.1	3.1
	08					2.2		20	0.49	5.7	0.83	1.4	4.9
	12	0.52	4.7	0.90	0.3	2.6	3 May	00	1.01	6.3	1.39	5.3	7.6
	16	0.93	5.3	1.21	1.6	4.0		04	0.92	6.5	1.23	5.6	9.8
	20	1.32	5.8	1.84	4.3	5.3		08	1.18	6.1	1.69	5.1	8.4
25 Apr	00	1.42	6.6	2.20	9.3	6.2		12	1.03	5.8	1.46	3.3	6.2
	04	1.46	6.2	1.91	7.1	7.1		16	1.24	6.0	1.71	5.1	4.9
	08	1.38	6.7	2.05	9.1	6.7		20	1.47	6.2	2.46	7.2	8.0
	12	1.67	7.6	2.70	16.2	6.2	4 May	00	0.98	5.9	2.57	3.6	10.7
	16	1.72	7.4	2.19	16.0	5.8		04	0.72	5.7	1.05	2.0	8.4
	20	1.57	7.3	2.40	13.8	7.1		08	0.70	5.7	2.91	2.0	8.0
26 Apr	00	1.57	6.7	2.18	10.3	7.6		12	0.54	5.2	3.45	0.8	8.0
	04	0.96	6.3	1.57	4.8	6.7		16	0.25	5.5	0.45	0.5	6.7
	08	1.08	5.7	2.22	3.3	8.9		20	0.12	5.4	0.21	0.2	7.1
	12	0.47	5.6	0.69	1.3	10.7	5 May	00	0.03	6.7	0.04	0.2	7.6
	16	0.80	5.9	1.37	2.9	9.3		04	0.06	6.2	0.09	0.3	3.5
	20	1.21	5.9	1.69	4.6	6.7		08	0.14	5.8	0.20	0.4	4.0
27 Apr	00	0.83	5.4	1.20	1.6	8.4		12	0.27	5.8	0.42	0.9	4.9
	04	0.68	5.2	1.14	1.0	8.0		16	0.35	6.0	0.57	1.4	6.2
	08	0.76	5.1	1.18	1.0	6.7		20	0.51	5.6	0.73	1.3	7.6
	12	0.57	5.4	0.84	1.1	6.7	6 May	00	0.48	6.0	1.61	2.0	8.9
	16	0.94	5.3	1.35	1.7	6.7		04	0.49	5.9	0.65	1.8	8.9
	20	0.67	5.3	0.97	1.2	6.2		08	0.18	6.1	0.31	0.7	8.9
28 Apr	00	0.36	5.0	0.68	0.4	8.0		12	0.07	5.8	0.11	0.2	7.1
	04	0.21	4.8	0.33	0.1	7.1		16	0.23	5.5	0.40	0.5	1.7
	08	0.15	5.1	0.27	0.2	6.7		20	0.95	5.8	1.41	3.1	2.2
	12	0.54	5.1	0.80	0.6	4.0	7 May	00	1.20	6.1	1.60	5.4	5.3
	16	0.17	5.0	0.31	0.1	4.4		04	1.08	6.7	1.48	7.2	5.3
	20	0.17	4.8	0.39	0.1	4.9		08	0.85	6.5	1.32	5.0	7.1
29 Apr	00	0.02	6.0	0.03	0.1	6.7		12	0.51	6.5	0.82	3.0	5.8
	04	0.01	6.2	0.02	0.0	5.8		16	0.33	5.7	0.49	1.0	7.1
	08	0.01	5.9	0.02	0.0	4.0		20	0.11	5.5	0.14	0.2	4.4
	12	0.04	5.5	0.05	0.0	1.7	8 May	00	0.60	5.7	2.82	1.8	4.0
	16	0.02	5.4	0.03	0.0	2.2		04	0.11	5.3	0.14	0.1	6.2
	20	0.01	8.1	0.01	0.01	2.2		08	0.36	5.1	4.33	0.5	7.1

(continued)

Table L'6 (concluded)

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
8 May	12	0.26	5.0	0.39	0.2	3.5	10 May	00	0.14	5.7		0.4	6.2
	16	0.30	5.2		0.5	4.4		04	0.03	6.2	0.15	0.1	4.0
	20	0.10	5.6	0.15	0.2	5.8		08	0.04	5.2	0.05	0.0	3.1
9 May	00	0.05	6.1	0.11	0.2	7.1		12	0.02	6.8	0.03	0.1	3.5
	04	0.06	5.6	0.12	0.1	5.8		16	0.02	7.0	0.03	0.1	3.1
	08	0.19	5.5	0.31	0.4	2.6		20	0.82	4.8		0.5	6.2
	12	0.43	6.1	0.73	1.9	4.0	11 May	00	0.56	4.0	1.49	0.0	5.3
	16	0.39	6.2	1.56	1.8	3.1		04					
	20	0.27	6.0		1.1	7.1		08	0.36	5.1	3.20	0.4	2.6
								12	0.07	5.1	0.10	0.0	4.0

Table L'7

Wave Data for 12 May to 7 June 1976

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
12 May	20	0.97	6.1	1.78	4.4	4.0	21 May	08	0.07	6.5	0.29	0.4	1.3
13 May	00	0.00	7.7	0.01	0.0	2.2		12	0.03	6.2	0.05	0.1	7.1
	04	0.00	6.3	0.00	0.0	3.1		16	0.06	5.7	0.07	0.1	6.7
	08	0.01	5.7	0.02	0.0	3.5		20	0.09	5.5	0.16	0.2	3.1
	12	0.04	5.7	0.13	0.1	4.0	22 May	00	0.02	6.1	0.03	0.1	2.6
	16	0.01	7.6	0.01	0.1	3.5		04	0.04	5.8	0.36	0.1	4.9
	20	0.03	5.6	0.05	0.0	4.4		08	0.01	6.7	0.01	0.1	3.1
14 May	00	0.02	5.3	0.03	0.0	1.7		12	0.09	5.8	0.64	0.3	1.7
	04					6.2		16	0.03	5.8	0.03	0.1	3.5
	08					5.8		20	0.01	6.7	0.01	0.0	4.4
	12	0.04	5.8	0.14	0.1	4.4	23 May	00	0.03	5.5	0.05	0.0	3.5
	16	0.01	6.9	0.01	0.0	2.6		04	0.03	7.5	0.26	0.3	1.3
	20	0.01	5.7	0.01	0.0	2.2		08	0.01	6.5	0.01	0.0	1.3
15 May	00	0.00	6.8	0.01	0.0	2.6		12	0.01	6.1	0.02	0.0	4.0
	04	0.02	5.0	0.02	0.0	1.3		16	0.01	5.8	0.02	0.0	3.1
	08	0.00	7.0	0.01	0.0	2.6		20	0.01	7.3	0.06	0.1	3.5
	12	0.03	5.2	0.05	0.0	4.4	24 May	00	0.05	5.8	0.49	0.1	5.3
	16	0.04	5.5	0.07	0.1	3.5		04	0.17	5.1	0.63	0.2	0.8
	20	0.14	4.9	0.25	0.1	4.4		08	0.08	5.4	0.40	0.1	3.5
16 May	00	0.24	4.6	0.43	0.1	3.1		12	0.04	6.3	0.33	0.2	4.0
	04	0.07	5.5	0.11	0.1	1.7		16	0.01	6.8	0.02	0.1	4.0
	08	0.02	6.6	0.04	0.1	3.5		20	0.11	5.7	0.42	0.3	4.0
	12	0.03	5.6	0.06	0.1	4.0	25 May	00	0.11	5.1	0.65	0.1	3.1
	16	0.01	6.1	0.02	0.0	3.5		04	0.01	6.0	0.02	0.0	3.5
	20	0.01	6.4	0.01	0.0	1.7		08	0.06	5.8	0.49	0.2	0.8
17 May	00					1.3		12	0.05	6.8	0.30	0.3	4.0
	04					4.4		16	0.14	5.1	0.87	0.1	3.5
	08					3.1		20					4.0
	12					4.9	26 May	00					4.4
	16	0.01	8.0	0.01	0.1	3.5		04	0.07	6.2	0.44	0.3	3.1
	20	0.01	6.3	0.02	0.0	3.1		08					3.1
18 May	00	0.09	5.3	0.17	0.1	4.9		12	0.02	6.2	0.07	0.1	3.1
	04	0.49	5.4	0.77	1.0	8.9		16	0.06	6.7	0.48	0.4	3.1
	08	0.74	5.6	1.05	2.0	10.7		20	0.26	5.1	1.40	0.3	4.0
	12	0.73	5.4	1.17	1.6	8.4	27 May	00					1.3
	16	0.44	5.1	0.75	0.5	8.0		04	0.18	6.3	0.70	0.9	2.2
	20	0.49	5.4	0.75	1.0	5.8		08	0.01	6.5	0.01	0.0	2.6
19 May	00	0.07	5.6	0.11	0.1	6.2		12	0.06	6.5	0.21	0.3	4.0
	04	0.41	5.2	0.67	0.6	7.1		16	0.31	4.8	0.69	0.2	4.0
	08	0.91	5.3	1.51	1.7	8.0		20	0.04	5.4	0.10	0.0	2.6
	12	1.21	6.1	1.64	5.4	8.4	28 May	00					1.7
	16	1.79	6.2	2.29	8.7	9.8		04	0.02	6.1	0.08	0.1	3.5
	20	0.98	6.2	1.61	4.7	8.4		08	0.39	4.6	2.60	0.1	3.5
20 May	00	0.55	5.4	0.83	1.2	4.4		12	0.01	7.1	0.02	0.0	5.8
	04	0.15	5.4	0.24	0.3	5.3		16					5.3
	08	0.07	5.6	0.14	0.2	3.5		20					4.4
	12	0.13	5.1	0.21	0.1	6.7	29 May	00					3.1
	16	0.31	4.8	0.53	0.2	7.6		04					4.0
	20	0.41	5.5	0.64	1.0	8.4		08					4.4
21 May	00	0.25	5.6	0.34	0.6	3.5		12	0.13	6.7	0.32	0.8	5.8
	04	0.14	5.5	0.30	0.3	2.6		16	0.40	6.5	0.43	2.3	4.0

(continued)

Table L'7 (concluded)

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
29 May	20	0.87	5.0	1.00	0.8	3.5	3 Jun	08	0.39	5.1	1.71	0.4	2.6
30 May	00					2.2		12	1.27	4.4		0.3	4.4
	04					3.1		16	0.87	4.5	1.44	0.3	5.3
	08					2.2		20	1.29	4.5		0.4	4.4
	12					3.1	4 Jun	00					2.6
	16	0.08	6.3	0.33	0.4	4.9		04	0.62	5.1	0.67	0.8	1.7
	20	0.13	6.3	0.44	0.6	4.4		08	0.03	6.6	0.27	0.2	2.2
31 May	00	0.18	5.8	0.51	0.6	2.6		12	0.02	5.7	0.10	0.0	3.1
	04	0.16	6.0	0.67	0.6	3.1		16	0.01	5.6	0.02	0.0	4.4
	08					4.0		20					4.0
	12					4.0	5 Jun	00	0.01	5.7	0.01	0.0	4.4
	16	0.31	5.5	0.71	0.7	7.6		04	0.01	7.1	0.01	0.0	1.3
	20	0.20	5.7	0.77	0.6	5.3		08	0.04	6.0	0.08	0.1	0.8
1 Jun	00	0.16	6.2	0.42	0.7	0.8		12	0.05	8.8	0.05	0.6	2.6
	04	1.16	4.5	1.49	0.4	0.4		16	0.02	6.3	0.03	0.1	4.0
	08	0.28	5.0	1.38	0.2	0.8		20	0.01	6.3	0.02	0.0	2.6
	12					2.6	6 Jun	00	0.01	5.7	0.02	0.0	2.6
	16					4.0		04	0.01	5.8	0.01	0.0	0.8
	20	0.56	5.4	1.24	1.1	6.2		08	0.00	6.5	0.00	0.0	0.4
2 Jun	00	0.45	5.7	0.97	1.3	4.4		12	0.01	6.9	0.01	0.0	1.7
	04	0.24	5.8	0.91	0.8	3.5		16	1.36	4.4		0.3	4.0
	08	0.23	5.2	1.34	0.3	4.0		20	0.25	6.1	0.30	1.1	5.8
	12	0.25	5.6	0.99	0.6	4.9	7 Jun	00	1.79	4.3	1.91	0.3	4.4
	16	0.21	5.8	0.87	0.7	4.0		04	1.41	4.4		0.3	2.2
	20	0.40	6.2	0.97	1.9	4.0		08					2.2
3 Jun	00	0.14	6.3	0.75	0.7	3.1		12	0.88	4.7	1.58	0.5	6.7
	04	0.73	5.4	1.29	1.4	1.3		16	0.54	5.3	1.27	1.0	4.9

Table L'8

Wave Data for 8 June to 29 June 1976

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
8 Jun	20	0.00	7.5	0.01	0.0	3.5	17 Jun	08	0.02	6.2	0.02	0.0	2.2
9 Jun	00	0.00	6.6	0.00	0.0	2.6		12	0.01	6.4	0.02	0.0	4.4
	04	0.00	6.5	0.00	0.0	2.2		16	0.01	6.4	0.01	0.0	3.1
	08	0.07	4.6	0.13	0.0	3.1		20	0.00	7.3	0.00	0.0	1.3
	12	0.05	5.3	0.08	0.1	4.9	18 Jun	00	0.01	5.7	0.01	0.0	2.2
	16					4.0		04	0.05	5.7	0.06	0.1	3.1
	20	0.01	6.2	0.02	0.0	1.7		08	0.02	6.0	0.08	0.0	3.5
10 Jun	00	0.00	7.5	0.01	0.0	2.2		12					4.0
	04	0.01	6.3	0.01	0.0	2.6		16					3.5
	08	0.02	5.8	0.14	0.0	3.1		20					3.1
	12	0.01	5.5	0.01	0.0	3.1	19 Jun	00	0.01	6.7	0.01	0.0	3.5
	16	0.01	6.2	0.01	0.0	5.3		04	0.02	6.1	0.04	0.1	1.3
	20					2.2		08	0.16	4.7	0.22	0.0	4.0
11 Jun	00	0.02	5.8	0.04	0.0	3.1		12	0.01	7.0	0.02	0.1	4.0
	04					4.0		16					4.4
	08	0.17	4.8	0.25	0.1	3.5		20	0.15	4.7	0.22	0.0	2.6
	12	0.51	5.1	0.81	0.7	6.2	20 Jun	00	0.37	4.6	0.49	0.1	4.9
	16	0.57	5.2	0.80	0.8	7.1		04	0.01	8.2	0.01	0.1	4.0
	20	0.34	5.1	0.52	0.4	6.2		08	0.02	5.9	0.04	0.0	6.2
12 Jun	00	0.12	5.2	0.25	0.1	0.8		12	0.28	4.7	0.41	0.1	5.3
	04	0.02	6.3	0.02	0.1	2.2		16	0.13	4.8	0.21	0.1	3.1
	08	0.23	4.4	0.36	0.0	4.9		20	0.02	5.6	0.02	0.0	3.1
	12	0.75	5.6	1.10	1.9	5.8	21 Jun	00	0.00	6.4	0.01	0.0	3.5
	16	0.61	5.6	0.83	1.7	5.8		04	0.00	6.7	0.01	0.0	4.4
	20	0.72	5.3	1.09	1.2	5.3		08	0.10	4.8	0.16	0.0	4.0
13 Jun	00	0.37	5.0	0.61	0.4	0.4		12	0.92	5.4	1.37	1.9	4.4
	04	0.25	5.1	0.34	0.3	3.1		16	0.66	5.6	0.87	1.8	4.0
	08	0.12	5.3	0.23	0.2	4.9		20	0.47	5.2	0.72	0.7	2.2
	12	0.03	6.5	0.12	0.1	4.4	22 Jun	00	0.20	4.9	0.31	0.2	1.3
	16	0.01	6.2	0.01	0.0	4.4		04	0.04	5.3	0.06	0.0	1.7
	20	0.01	7.0	0.01	0.0	3.5		08	0.01	6.8	0.01	0.0	3.1
14 Jun	00	0.00	7.0	0.01	0.0	4.9		12	0.03	5.4	0.04	0.0	2.6
	04					4.9		16	0.01	6.8	0.02	0.0	4.0
	08	0.01	6.1	0.02	0.0	5.3		20	0.01	6.0	0.02	0.0	3.5
	12	0.01	7.8	0.01	0.1	5.8	23 Jun	00				0.0	
	16	0.01	7.7	0.01	0.1	5.3		04	0.03	5.4	0.03	0.0	1.7
	20	0.02	5.8	0.03	0.0	4.4		08	0.00	7.1	0.00	0.0	2.6
15 Jun	00	0.03	6.9	0.25	0.2	5.3		12				0.0	2.6
	04	0.10	4.8	0.14	0.0	4.0		16	0.01	5.3	0.01	0.0	2.6
	08	0.03	5.4	0.06	0.0	4.0		20	0.00	7.0	0.00	0.0	1.3
	12	0.01	6.3	0.02	0.0	5.3	24 Jun	00	0.01	5.6	0.02	0.0	0.8
	16	0.01	7.5	0.01	0.1	7.1		04					2.6
	20	0.04	5.9	0.07	0.1	6.7		08				0.0	2.6
16 Jun	00	0.16	5.2	0.29	0.2	7.1		12	0.01	5.5	0.03	0.0	2.2
	04	0.30	5.6	0.45	0.8	5.3		16					5.3
	08	0.17	5.9	0.28	0.6	3.5		20					5.3
	12	0.17	5.3	0.25	0.3	4.4	25 Jun	00				0.9	6.7
	16	0.05	6.1	0.08	0.2	2.6		04	0.39	5.5	0.53	0.9	7.1
	20	0.11	5.1	0.18	0.1	2.2		08	0.49	5.5	0.71	1.1	6.7
17 Jun	00	0.18	4.9	0.30	0.1	1.7		12	0.42	5.1	0.70	0.5	6.7
	04	0.04	5.5	0.20	0.1	1.7		16	0.31	4.8	0.31	0.2	6.2

(continued)

Table L'8 (concluded)

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
25 Jun	20	0.20	5.1	0.31	0.2	4.4	27 Jun	16	0.01	6.6	0.01	0.0	4.9
26 Jun	00	0.06	5.4	0.12	0.1	3.1		20	0.01	6.9	0.02	0.0	2.2
	04	0.01	7.3	0.01	0.1	2.6	28 Jun	00	0.01	5.7	0.02	0.0	2.6
	08	0.01	6.6	0.01	0.0	3.1		04	0.00	6.7	0.01	0.0	3.1
	12	0.02	5.8	0.03	0.0	6.2		08	0.01	6.5	0.01	0.0	2.6
	16	0.01	7.5	0.01	0.1	6.2		12	0.01	6.6	0.01	0.0	6.7
	20	0.01	6.7	0.03	0.0	4.0		16	0.05	5.3	0.08	0.1	2.6
27 Jun	00	0.02	5.9	0.03	0.0	3.1		20					4.0
	04	0.03	5.5	0.05	0.0	3.1	29 Jun	00	0.02	6.0	0.03	0.0	3.5
	08	0.07	5.1	0.10	0.0	4.0		04					2.6
	12	0.02	6.2	0.02	0.1	4.4		08	0.17	4.7	0.47	0.0	2.6

Table L'9

Wave Data for 7 July to 30 July 1976

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
7 Jul	20					1.7	16 Jul	08	0.54	5.6	0.76	1.4	4.0
8 Jul	00	0.02	6.1	0.04	0.1	3.5		12	0.22	5.3	0.34	0.4	5.8
	04	0.10	5.0	0.14	0.1	4.4		16	0.07	5.9	0.28	0.2	4.0
	08	0.05	5.5	0.10	0.1	2.2		20	0.31	5.1	0.44	0.4	5.3
	12	0.01	7.2	0.02	0.1	4.0	17 Jul	00	0.16	5.1	0.30	0.2	6.2
	16	0.02	5.7	0.03	0.0	3.5		04	0.03	6.1	0.04	0.1	2.6
	20	0.65	5.0	0.99	0.7	5.3		08	0.21	4.9	0.39	0.2	4.9
9 Jul	00	0.25	5.2	0.44	0.3	4.4		12	0.04	5.4	0.15	0.0	4.4
	04	0.19	4.9	0.31	0.1	2.6		16	0.31	4.5	2.87	0.1	6.7
	08	0.12	4.8	0.19	0.0	0.8		20	0.39	5.1	1.64	0.5	3.5
	12	0.01	6.9	0.02	0.1	3.1	18 Jul	00	0.27	5.0	1.54	0.3	3.5
	16	0.01	6.3	0.01	0.0	4.0		04	0.13	5.0	0.18	0.1	3.1
	20	0.01	5.2	0.01	0.0	2.2		08	0.28	5.0	0.88	0.3	3.1
10 Jul	00	0.01	6.0	0.01	0.0	1.7		12	0.35	5.1	1.24	0.5	5.8
	04					3.1		16	0.47	5.0	1.56	0.5	6.7
	08	0.04	6.8	0.05	0.2	3.5		20	0.12	5.4	0.17	0.2	3.5
	12	0.17	6.4	0.22	0.9	7.1	19 Jul	00	0.13	5.1	1.27	0.1	3.1
	16	0.30	5.6	0.51	0.8	4.9		04	0.09	5.3	0.15	0.1	3.5
	20	0.15	5.5	0.21	0.3	3.5		08	0.26	5.5	0.83	0.6	3.1
11 Jul	00	0.16	5.1	0.67	0.2	4.0		12	0.20	5.1	0.27	0.2	5.3
	04	0.78	5.2	1.14	1.2	4.4		16	0.28	5.1	1.27	0.3	5.3
	08	0.55	5.4	0.90	1.1	7.6		20	0.12	5.1	1.40	0.1	1.7
	12	1.06	5.2	1.64	1.5	8.9	20 Jul	00	0.10	5.8	0.79	0.3	2.6
	16	0.55	5.4	0.81	1.0	5.8		04	0.00	6.7	0.01	0.0	2.6
	20	0.09	5.7	0.15	0.2	2.6		08	0.07	5.5	0.14	0.1	4.0
12 Jul	00	0.04	5.9	0.10	0.1	2.6		12	0.36	5.5	0.56	0.8	6.2
	04	1.09	5.8	1.63	3.5	5.3		16	0.32	5.6	0.48	0.8	4.9
	08	1.71	6.5	2.09	10.2	10.7		20	0.27	5.1	0.39	0.3	4.0
	12	1.11	6.2	1.56	5.4	8.0	21 Jul	00	0.20	5.4	1.10	0.4	3.5
	16	1.06	6.4	1.85	5.7	7.6		04	0.64	5.0	1.93	0.7	4.4
	20	0.49	6.1	0.98	2.1	8.0		08	0.32	5.1	1.67	0.3	4.0
13 Jul	00	0.59	5.3	1.02	1.0	8.9		12	0.08	5.3	0.12	0.1	1.7
	04	0.73	5.7	1.04	2.3	6.7		16	0.05	5.5	0.07	0.1	3.5
	08	0.88	5.8	1.47	2.9	7.1		20	0.16	5.8	0.68	0.5	4.0
	12	0.68	5.3	1.16	1.2	6.7	22 Jul	00	0.01	6.6	0.01	0.0	3.1
	16	0.41	5.5	0.61	0.9	7.6		04	0.09	5.8	0.82	0.3	3.1
	20	0.66	5.1	1.07	0.8	5.8		08	0.07	5.7	0.74	0.2	3.1
14 Jul	00	0.08	6.0	0.78	0.3	4.4		12	0.13	5.8	0.83	0.4	4.0
	04	0.01	6.4	0.02	0.1	0.8		16	0.47	4.9	1.98	0.4	4.9
	08	0.01	5.9	0.02	0.0	1.7		20	0.26	4.8	1.69	0.2	2.6
	12	0.01	6.7	0.01	0.0	2.6	23 Jul	00	0.06	6.8	0.46	0.4	2.2
	16	0.01	5.8	0.02	0.0	3.5		04					4.0
	20	0.01	6.8	0.02	0.1	1.3		08	0.04	7.7	0.35	0.5	3.1
15 Jul	00	0.20	5.3	0.29	0.4	5.8		12	0.13	6.6	0.49	0.8	4.0
	04					3.5		16	0.14	4.9	0.19	0.1	4.9
	08					0.4		20	0.30	5.1	1.54	0.4	4.0
	12					2.6	24 Jul	00	0.19	5.7	0.99	0.5	2.6
	16					3.1		04	0.01	6.0	0.02	0.0	2.2
	20					1.3		08	0.21	4.8	0.34	0.1	3.1
16 Jul	00					3.1		12	0.19	5.1	1.14	0.2	4.0
	04	0.60	6.0	0.85	2.4	4.4		16	0.31	5.0	1.58	0.3	4.9

(continued)

Table L'9 (concluded)

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
24 Jul	20	0.59	5.2	0.84	0.9	7.1	27 Jul	16	0.10	6.9	0.69	0.7	4.4
25 Jul	00	0.23	5.8	1.05	0.7	6.7		20	0.07	6.2	0.15	0.3	2.2
	04	0.29	5.3	1.30	0.5	3.5	28 Jul	00	0.10	6.4	0.31	0.5	1.7
	08	0.29	5.1	0.94	0.4	1.7		04	0.04	4.8	0.05	0.0	2.2
	12	0.09	5.1	0.16	0.1	3.1		08	0.04	6.6	0.20	0.3	2.2
	16	0.01	6.2	0.02	0.0	3.5		12	0.12	5.6	0.47	0.3	1.7
	20	0.26	5.6	0.93	0.6	0.8		16	0.09	5.0	0.59	0.0	3.1
26 Jul	00					2.6		20	0.04	7.5	0.22	0.4	2.2
	04					3.5	29 Jul	00	0.10	7.4	0.23	0.9	3.1
	08					4.0		04	0.22	6.2	0.35	1.0	3.5
	12	0.16	5.8	0.96	0.5	4.0		08	0.02	6.5	0.04	0.1	3.1
	16	0.09	5.6	0.39	0.2	5.3		12	0.41	5.3	1.76	0.7	4.9
	20	0.11	6.4	0.80	0.6	3.5		16	0.36	5.2	2.07	0.5	6.2
27 Jul	00	0.02	5.9	0.03	0.1	3.1		20	0.16	5.3	1.82	0.3	4.0
	04	0.06	6.6	0.27	0.4	3.5	30 Jul	00	0.05	5.9	0.10	0.2	4.0
	08	0.15	5.4	0.54	0.3	3.1		04	0.05	6.1	0.67	0.2	2.6
	12	0.15	5.5	0.56	0.3	3.1							

Table L'10

Wave Data for 30 July to 29 August 1976

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
30 Jul	16					2.6	8 Aug	00	0.62	5.0	0.92	0.7	11.6
	20					2.6		04	0.27	5.1	0.47	0.3	8.4
31 Jul	00					0.8		08	0.29	5.1	0.43	0.3	5.3
	04	0.19	4.8	0.28	0.1	1.7		12	0.04	6.0	0.07	0.1	5.8
	08	0.05	6.0	0.08	0.2	2.2		16	0.03	6.0	0.05	0.1	4.0
	12	1.29	6.0	1.63	5.1	2.6		20	0.02	5.9	0.03	0.0	3.5
	16	0.94	5.5	1.26	2.1	4.0	9 Aug	00	0.03	5.2	0.05	0.0	3.1
	20	0.44	5.2	0.61	0.6	4.4		04	0.01	6.0	0.03	0.0	1.3
1 Aug	00	0.53	5.0	0.83	0.6	9.8		08	0.02	5.5	0.02	0.0	1.7
	04	0.37	5.1	0.55	0.4	9.3		12	0.03	5.2	0.05	0.0	1.3
	08	0.12	5.0	0.53	0.1	6.2		16					2.2
	12	0.03	5.5	0.04	0.0	6.7		20	0.01	6.1	0.02	0.0	1.7
	16	0.27	4.9	0.43	0.2	4.4	10 Aug	00	0.01	6.2	0.01	0.0	2.6
	20	0.04	5.9	0.10	0.1	3.5		04	0.01	5.6	0.01	0.0	2.6
2 Aug	00	0.02	5.9	0.03	0.0	1.7		08	0.01	5.8	0.02	0.0	3.1
	04	0.02	5.6	0.04	0.0	5.8		12	0.00	6.4	0.01	0.0	1.7
	08	0.01	6.3	0.01	0.0	1.7		16	0.01	6.1	0.01	0.0	2.6
	12	0.34	5.1	0.48	0.4	1.3		20	0.00	6.2	0.00	0.0	2.6
	16	0.14	5.0	0.23	0.1	3.1	11 Aug	00					1.7
	20	0.02	6.0	0.03	0.1	4.0		04	0.01	7.5	0.01	0.1	2.6
3 Aug	00	0.01	7.8	0.01	0.1	5.3		08	0.08	4.7	0.12	0.0	2.6
	04	0.01	5.6	0.01	0.0	3.1		12	0.01	6.6	0.02	0.1	3.1
	08					1.7		16					3.5
	12	0.01	6.3	0.01	0.0	1.3		20	0.01	7.0	0.02	0.1	3.1
	16	0.01	5.8	0.01	0.0	3.1	12 Aug	00	0.03	6.8	0.04	0.2	2.6
	20	0.01	6.0	0.02	0.0	3.5		04	0.13	5.3	0.17	0.2	4.4
4 Aug	00					0.4		08	0.38	4.8	0.65	0.3	4.0
	04	0.00	7.0	0.01	0.0	2.6		12	0.21	5.1	0.32	0.2	4.4
	08	0.00	7.5	0.01	0.0	2.2		16	0.21	4.9	0.38	0.1	5.8
	12					3.1		20	0.89	5.8	1.46	3.1	4.4
	16					4.4	13 Aug	00	0.43	5.6	0.57	1.1	3.1
	20	0.01	7.5	0.01	0.1	2.6		04	0.25	5.0	0.41	0.2	5.8
5 Aug	00	0.10	5.3	0.17	0.1	0.8		08	0.31	4.9	0.50	0.2	2.6
	04	0.49	5.3	0.69	0.8	2.6		12	0.06	5.6	0.08	0.1	2.6
	08	0.46	5.4	0.61	0.8	3.1		16					5.3
	12	0.23	5.3	0.36	0.4	4.0		20	0.01	5.6	0.02	0.0	4.0
	16	0.19	5.2	0.39	0.3	4.9	14 Aug	00	0.07	4.6	0.07	0.0	3.1
	20	0.48	4.7	0.89	0.2	4.4		04					2.2
6 Aug	00	0.15	5.2	0.23	0.2	3.5		08					2.6
	04	0.61	4.9	0.77	0.5	2.6		12	0.01	5.4	0.03	0.0	2.6
	08	0.65	5.2	0.95	0.9	5.3		16	0.01	5.2	0.01	0.0	3.1
	12	0.83	5.3	1.62	1.4	5.3		20	0.07	5.3	0.10	0.1	2.2
	16	1.01	5.7	1.46	2.9	4.0	15 Aug	00	0.09	5.4	0.14	0.1	2.2
	20	1.34	5.8	2.20	4.4	4.9		04	0.09	5.0	0.12	0.1	2.2
7 Aug	00	1.38	6.4	1.92	7.5	4.9		08	0.01	7.7	0.01	0.1	4.9
	04	1.54	6.6	2.47	9.8	4.4		12	0.25	5.0	0.37	0.2	4.0
	08	1.10	6.3	1.46	5.5	4.4		16	0.06	5.2	0.08	0.1	4.0
	12	1.40	5.9	2.25	5.0	4.0		20	0.23	4.7	0.38	0.1	4.0
	16	1.03	5.7	1.73	3.1	8.0	16 Aug	00	0.04	5.8	0.05	0.1	4.9
	20	0.56	5.4	1.08	1.2	11.1		04	0.07	5.2	0.12	0.1	4.4

(continued)

Table L'10 (concluded)

Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec	Date	Time Hr	$H_{1/3}$ m	Period Sec	H max m	O.V. cm/sec	Wind m/sec
16 Aug	08	0.01	6.8	0.02	0.1	4.4	23 Aug	00					2.2
	12	0.09	5.1	0.12	0.1	4.0		04	0.02	6.1	0.03	0.1	3.1
	16	0.09	5.2	0.13	0.1	4.4		08					3.1
	20	0.01	7.1	0.01	0.1	4.4		12					2.2
17 Aug	00	0.01	7.1	0.01	0.0	4.4		16	0.20	4.8	0.26	0.1	3.5
	04	0.01	6.9	0.02	0.1	4.4		20	0.38	4.8	0.56	0.2	2.6
	08	0.01	5.5	0.02	0.0	1.7	24 Aug	00	0.13	4.9	0.18	0.1	3.1
	12	0.01	6.6	0.02	0.1	3.5		04	0.25	5.5	0.39	0.6	3.1
	16	0.01	6.9	0.02	0.1	3.1		08	0.55	4.9	0.74	0.5	2.2
	20	0.01	6.0	0.02	0.0	4.9		12	0.31	4.9	0.43	0.2	2.2
18 Aug	00	0.01	5.8	0.02	0.0	1.3		16	0.05	5.8	0.06	0.1	4.4
	04	0.00	7.5	0.00	0.0	0.8		20					4.9
	08	0.00	6.3	0.00	0.0	1.7	25 Aug	00					3.1
	12	0.01	5.6	0.01	0.0	0.8		04					2.2
	16	0.01	6.0	0.01	0.0	3.1		08					2.2
	20	0.03	4.7	0.06	0.0	2.2		12					1.3
19 Aug	00	0.01	6.0	0.01	0.0	1.3		16					4.0
	04	0.02	5.1	0.04	0.0	1.3		20					2.6
	08	0.00	6.6	0.00	0.0	3.1	26 Aug	00					1.3
	12	0.00	7.1	0.00	0.0	1.3		04					0.4
	16	0.03	5.0	0.04	0.0	3.5		08					1.7
	20	0.01	6.0	0.01	0.0	3.1		12					1.3
20 Aug	00	0.00	6.6	0.00	0.0	0.8		16					1.7
	04	0.00	6.8	0.01	0.0	2.6		20					3.5
	08	0.01	6.1	0.02	0.0	2.6	27 Aug	00					2.2
	12	0.01	6.0	0.01	0.0	3.5		04	0.02	7.5	0.03	0.2	3.1
	16	0.03	4.7	0.03	0.0	2.6		08	0.01	7.5	0.03	0.1	2.6
	20	0.02	5.3	0.03	0.0	3.1		12					4.0
21 Aug	00	0.01	6.0	0.02	0.0	2.2		16					4.4
	04	0.01	5.2	0.01	0.0	1.7		20	0.06	6.0	0.09	0.2	4.0
	08	0.02	5.9	0.03	0.0	2.6	28 Aug	00	0.13	5.4	0.21	0.2	4.0
	12					2.2		04	0.21	5.1	0.28	0.2	4.4
	16	0.01	5.8	0.01	0.0	3.5		08	0.12	5.4	0.18	0.2	4.4
	20	0.08	4.4	0.15	0.0	2.6		12	0.31	4.9	0.52	0.2	4.4
22 Aug	00	0.01	6.2	0.01	0.0	0.8		16	0.14	5.2	0.18	0.2	2.2
	04	0.00	7.2	0.01	0.0	1.3		20	0.63	5.2	1.17	0.9	4.0
	08	0.02	5.3	0.03	0.0	1.7	29 Aug	00	0.66	5.3	1.01	1.1	2.6
	12					0.8		04	0.60	5.1	1.01	0.8	5.3
	16					2.6		08	0.92	5.4	1.18	1.9	7.1
	20					3.5		12	0.49	5.3	0.75	0.8	4.9

APPENDIX M': SIGNIFICANT WAVE HEIGHT PLOTS

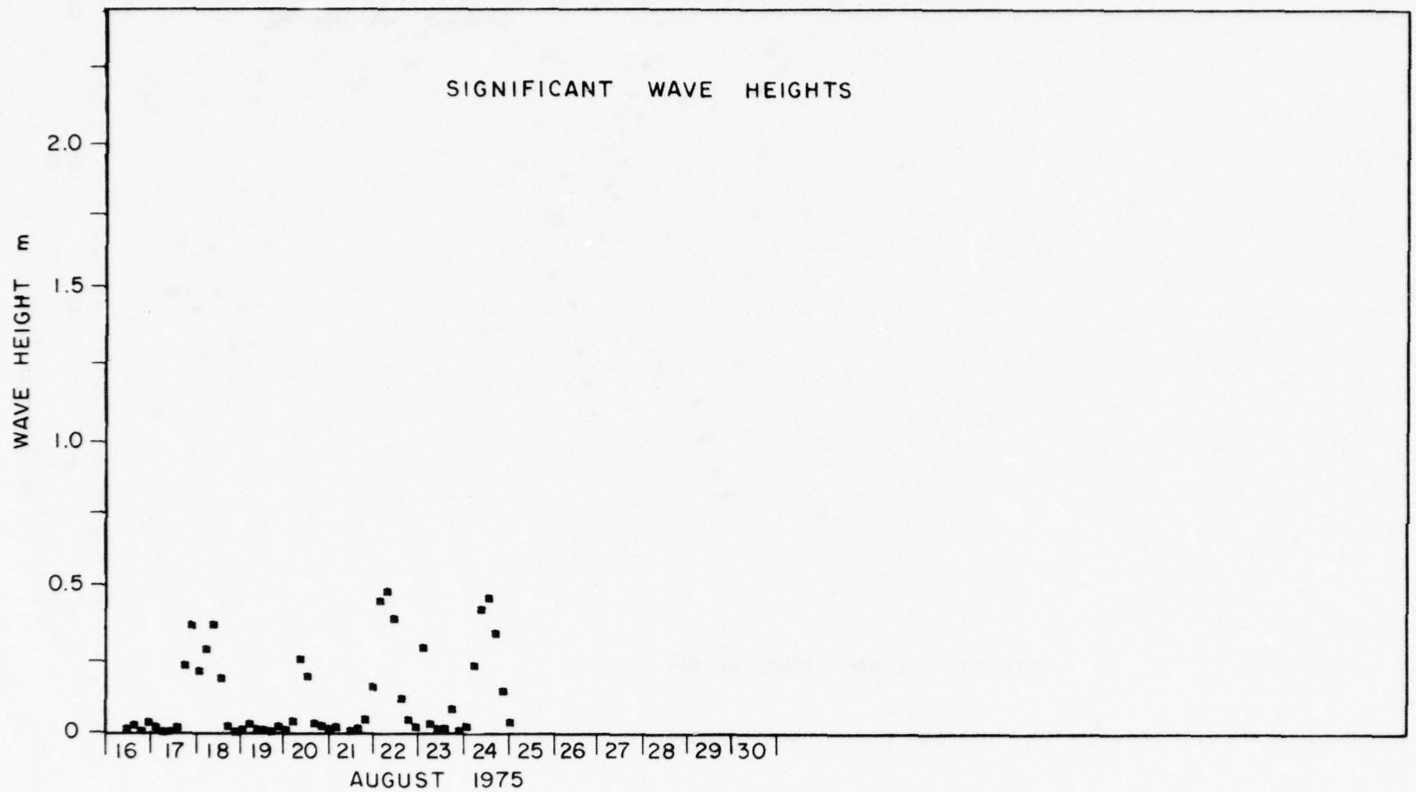


Figure M'1. Significant wave heights for 16 August to 25 August 1975

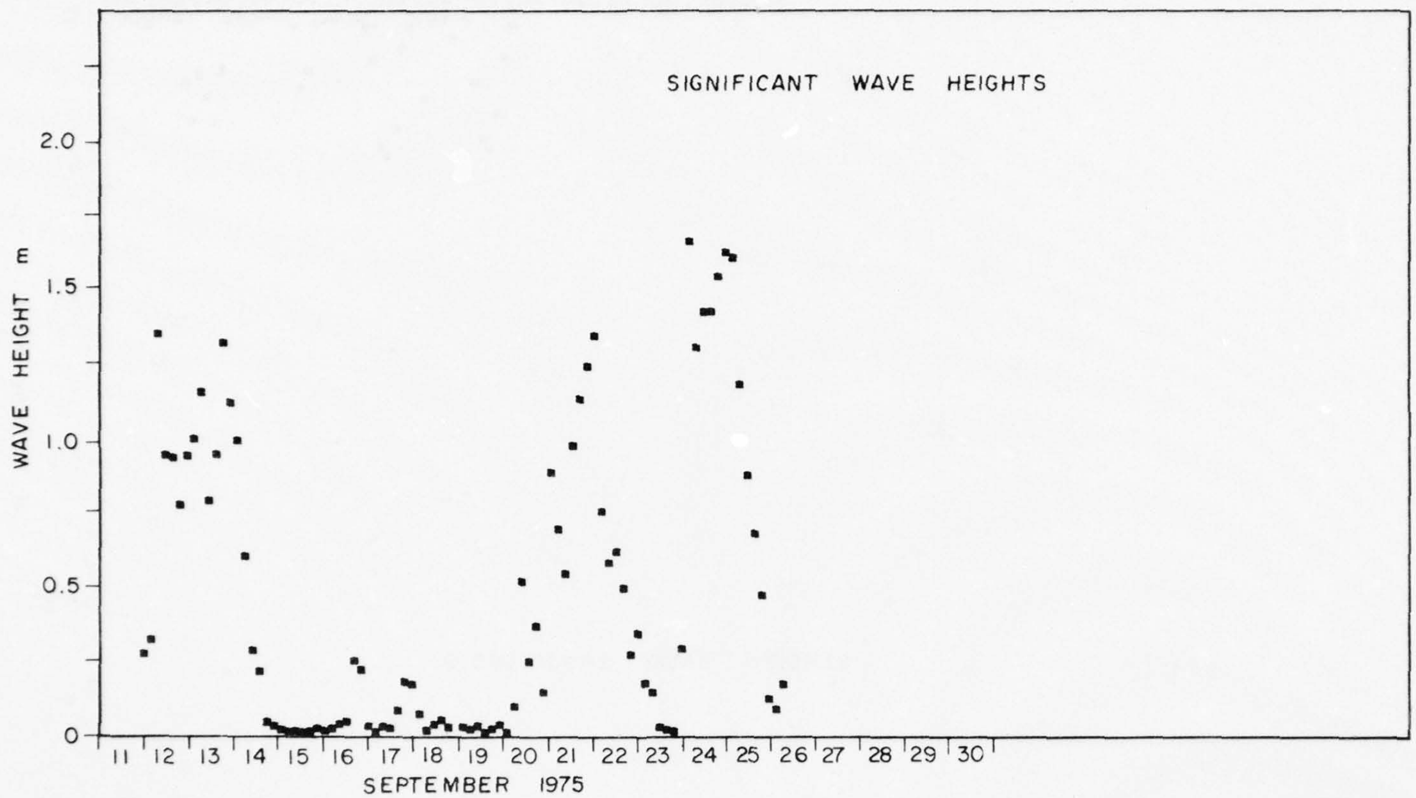


Figure M'2. Significant wave heights for 11 September to 26 September 1975

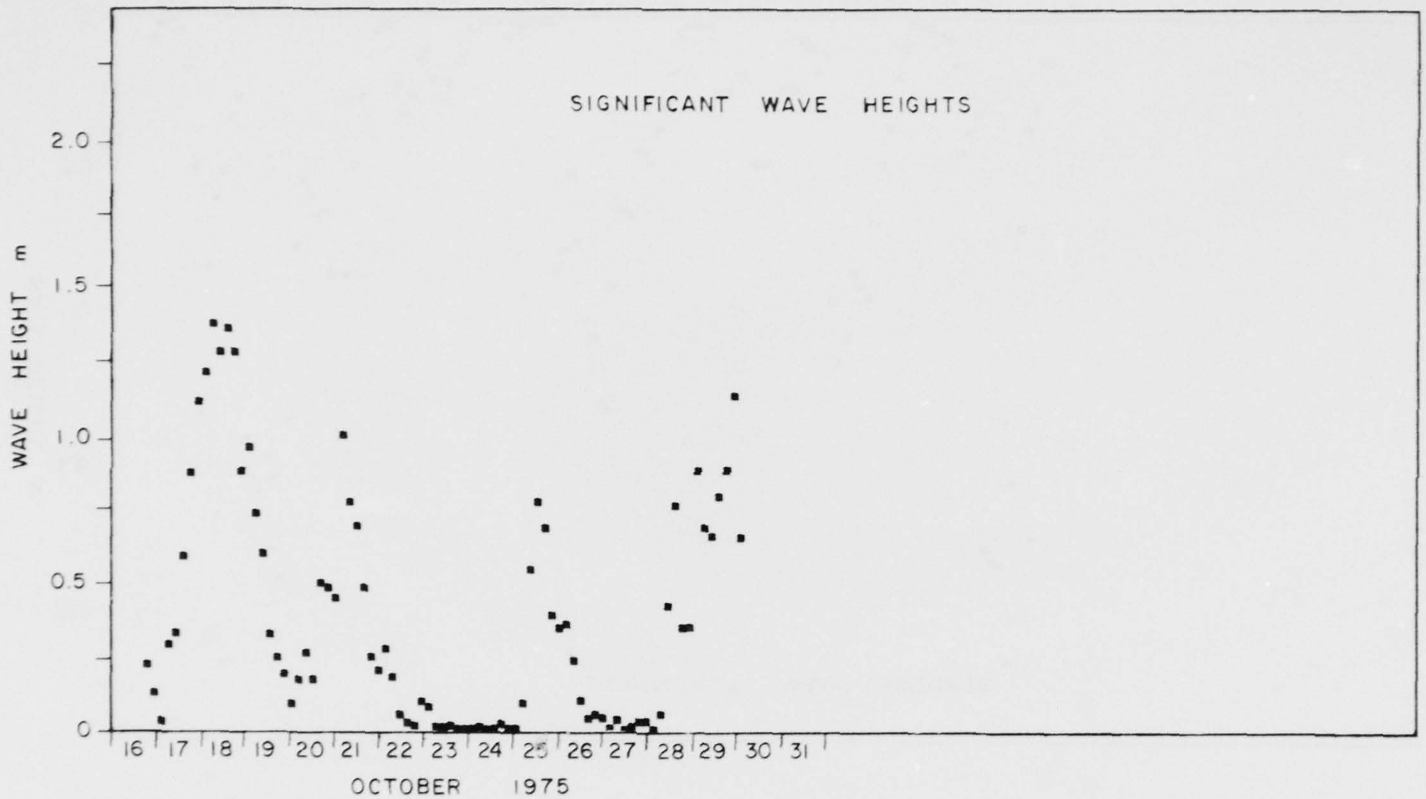


Figure M'3. Significant wave heights for 16 October to 30 October 1975

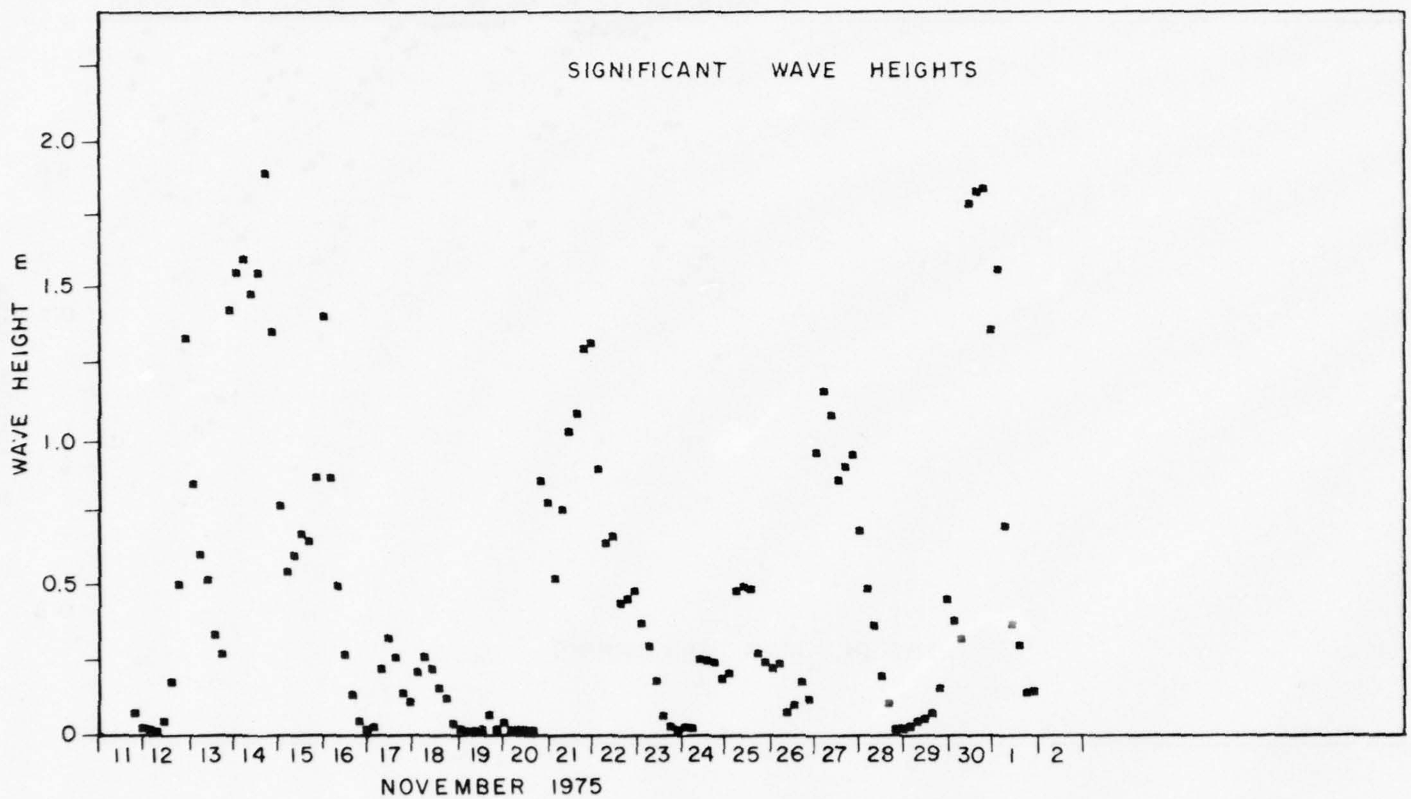


Figure M'4. Significant wave heights for 11 November to 2 December 1975

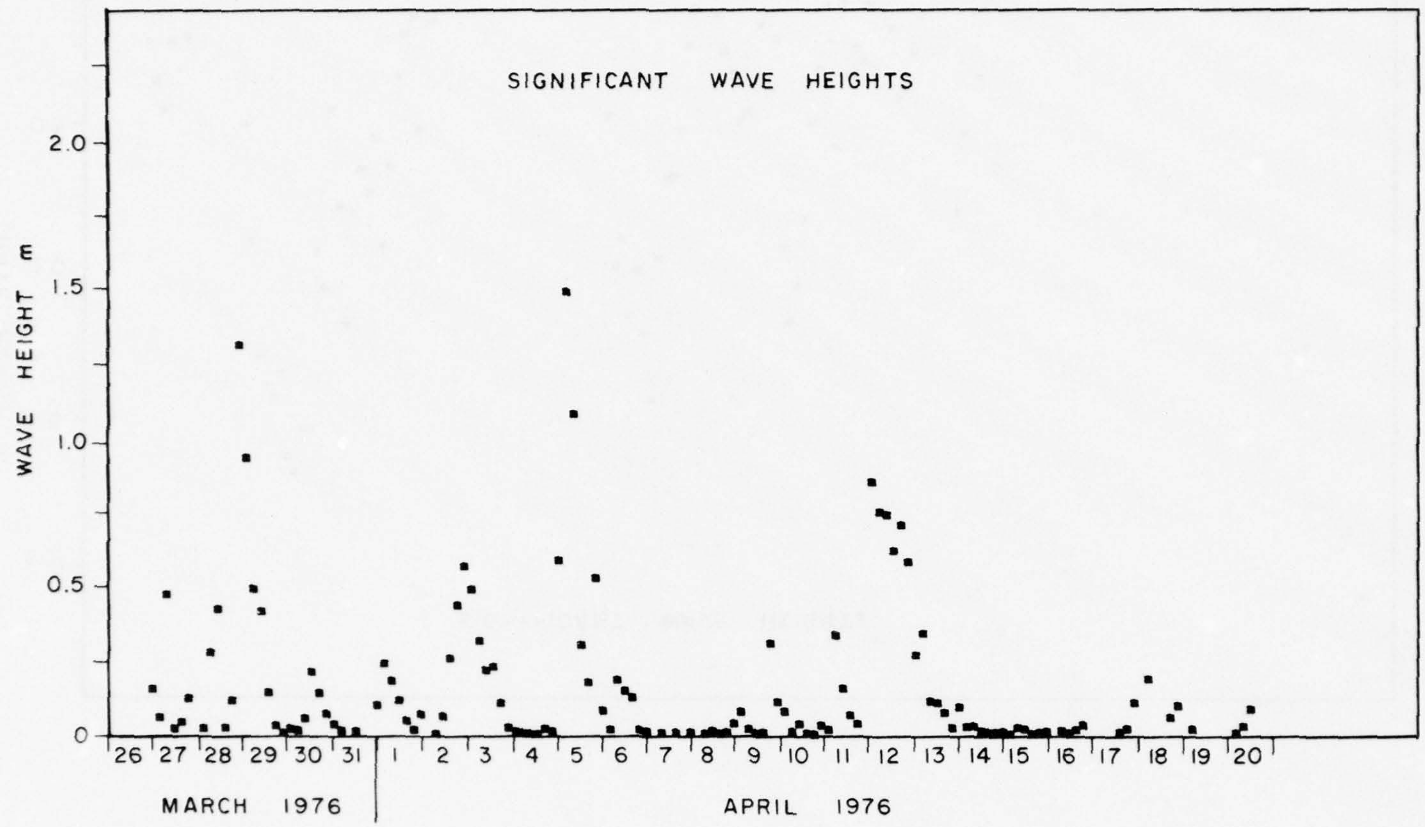


Figure M'5. Significant wave heights for 26 March to 20 April 1976

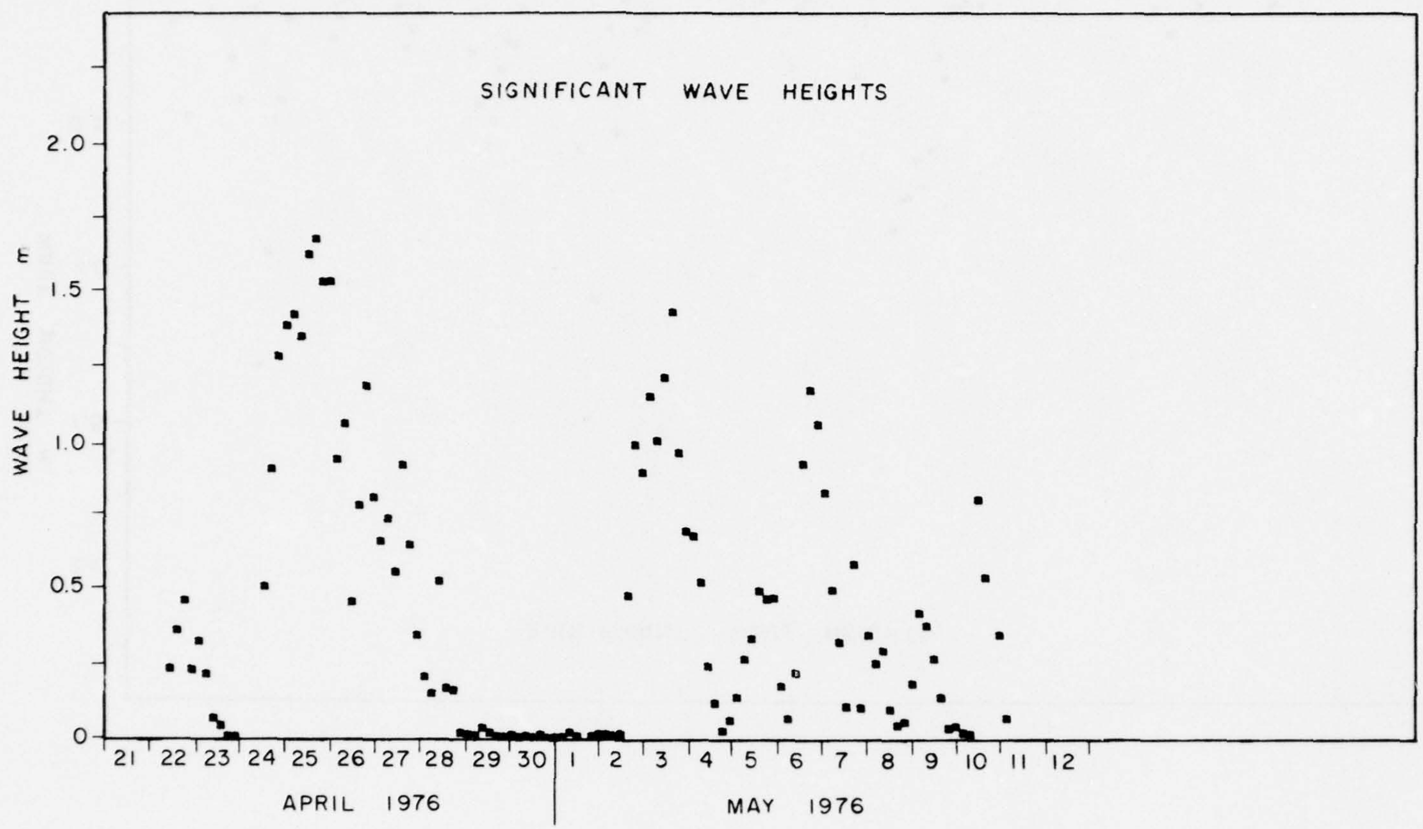


Figure M'6. Significant wave heights for 22 April to 11 May 1976

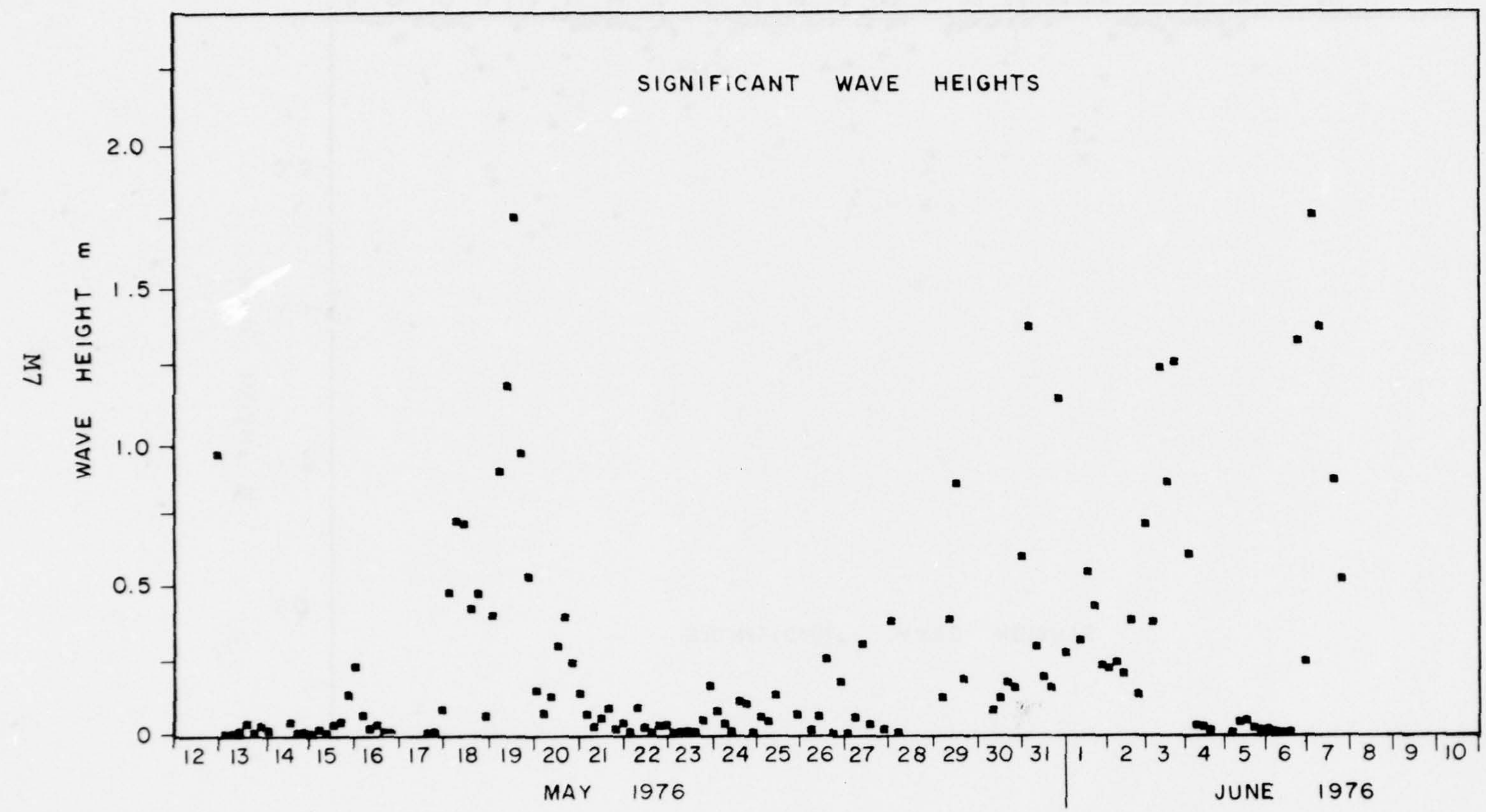


Figure M'7. Significant wave heights for 12 May to 7 June 1976

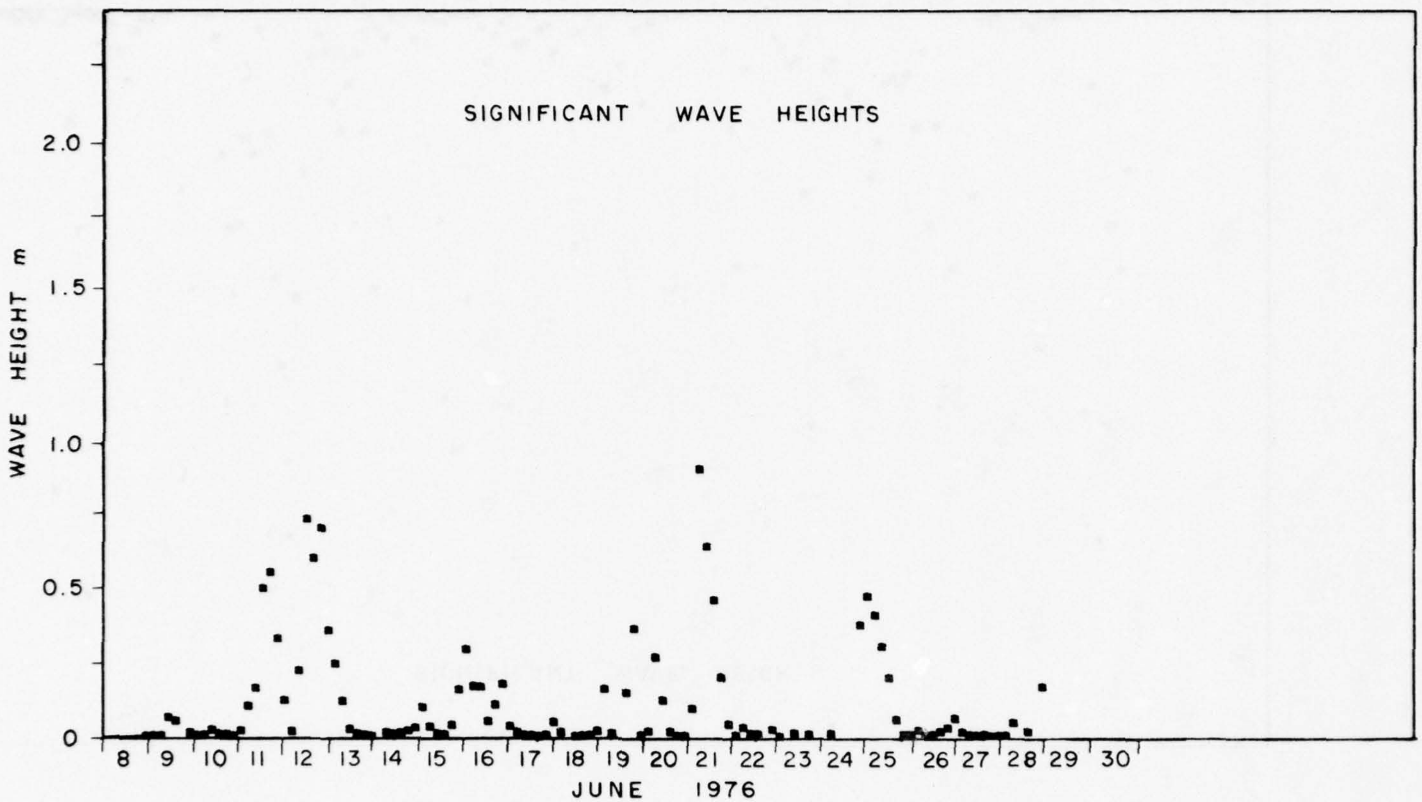


Figure M'8. Significant wave heights for 8 June to 29 June 1976

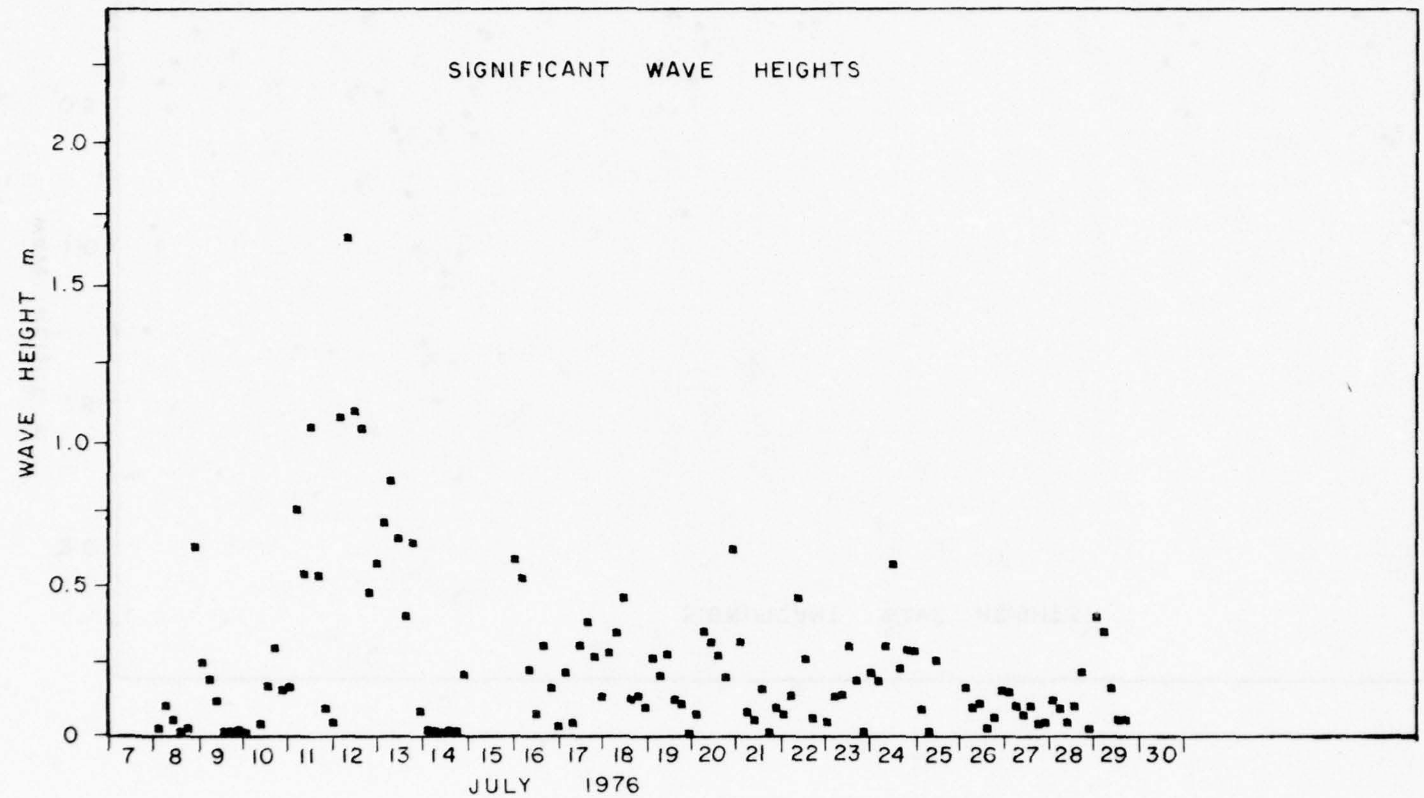


Figure M'9. Significant wave heights for 8 July to 29 July 1976

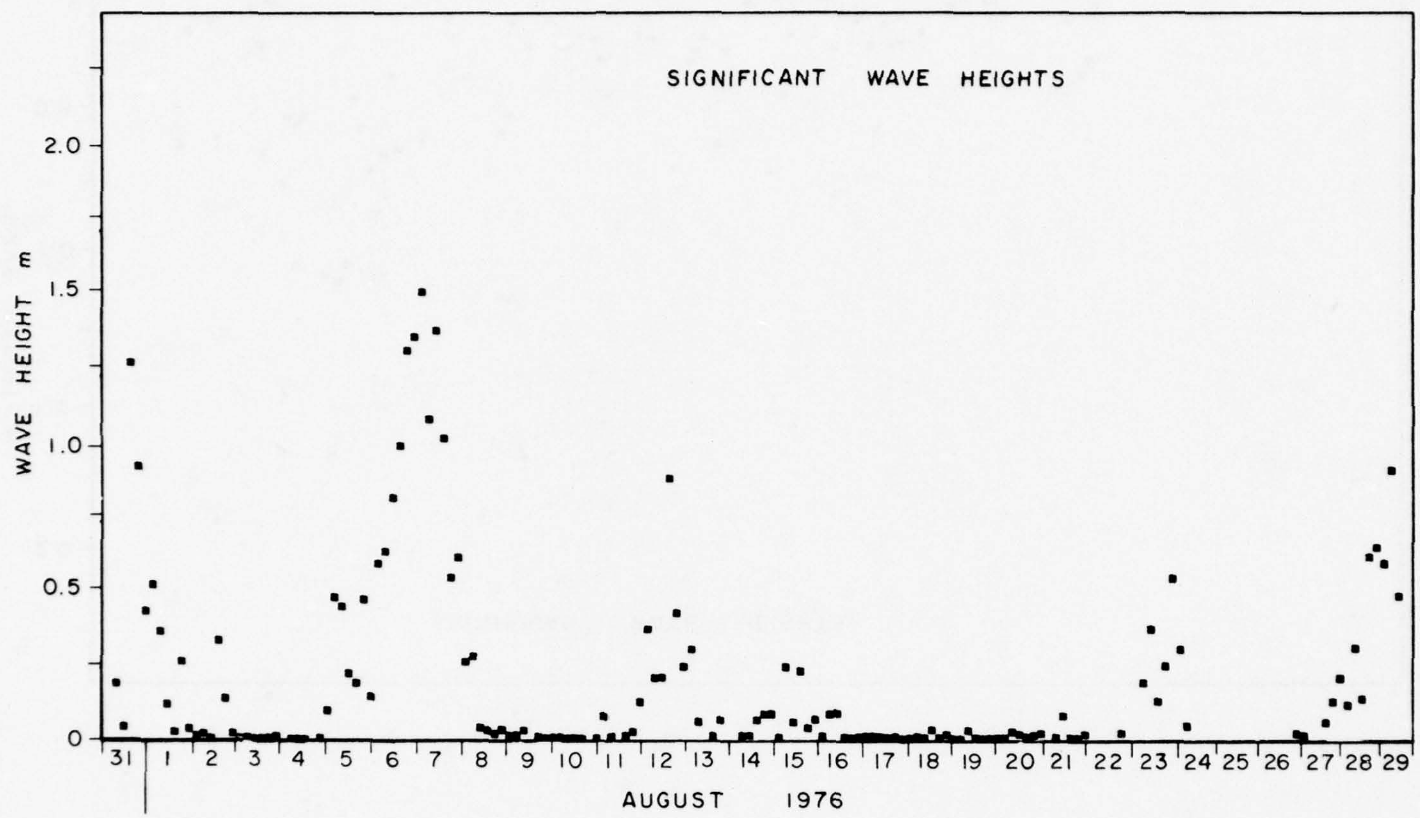


Figure M'10. Significant wave heights for 31 July to 29 August 1976

APPENDIX N': WIND SPEED AND DIRECTION TABLES

Table N'1

Wind Speed in meters per second for July 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	3	1	1	1	1	2	1	2	2	3	2	4	4	4	4	4	4	3	2	2	1	1	1	1	2
2	1	2	2	2	2	2	3	2	3	3	4	4	4	6	6	6	6	5	5	4	4	4	3	3	4
3	3	3	4	3	3	2	3	4	4	4	5	5	6	4	5	5	6	4	4	4	4	4	4	3	4
4	3	2	4	4	2	1	1	0	2	2	3	4	4	4	4	4	3	2	2	2	3	2	2	2	3
5	2	1	1	2	2	2	1	1	2	2	2	2	3	3	3	3	4	3	2	2	1	2	1	2	2
6	3	3	3	3	3	4	3	3	3	3	3	4	3	4	4	4	3	4	4	4	3	2	2	2	3
7	3	3	3	4	4	4	3	3	4	3	3	3	2	3	4	4	4	4	3	2	2	2	2	3	3
8	2	3	2	3	2	3	4	4	3	2	2	3	3	4	4	4	5	4	3	3	3	2	1	2	3
9	4	3	3	4	4	1	4	4	4	4	4	3	3	3	2	4	4	4	4	3	3	2	2	2	3
10	2	2	3	2	3	3	2	3	3	3	4	4	4	5	4	5	2	4	2	3	4	3	3	5	3
11	8	6	5	6	6	5	4	3	4	3	4	3	4	3	3	4	4	4	4	4	4	3	2	2	4
12	2	3	3	3	3	2	3	3	3	3	2	3	2	3	4	4	4	4	5	4	5	5	4	3	3
13	3	2	3	3	3	3	3	2	3	2	2	2	2	3	3	4	4	4	4	4	4	4	6	4	3
14	5	3	3	4	3	3	3	3	4	3	4	4	4	3	6	6	6	6	4	5	5	6	4	3	4
15	2	3	3	3	2	2	2	3	3	3	3	3	4	4	3	3	3	3	3	3	2	2	1	1	3
16	1	2	2	2	3	3	3	2	3	3	3	3	2	2	3	4	3	3	3	2	2	2	1	2	2
17	2	3	3	3	3	3	2	3	3	3	3	2	3	4	4	4	4	4	3	1	1	1	0	0	3
18	1	2	2	3	3	2	3	2	3	3	4	4	4	4	5	5	5	5	4	6	4	2	2	2	3
19	4	3	3	4	4	4	4	4	4	5	5	6	5	6	6	7	6	7	5	4	4	4	3	4	5
20	4	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	2	4
21	2	3	3	3	3	3	3	2	3	3	3	5	6	6	6	5	5	5	5	5	4	4	3	1	4
22	1	2	2	2	2	2	3	3	3	3	2	2	3	4	4	4	6	6	5	5	4	3	2	2	3
23	1	3	3	3	3	3	3	4	3	3	2	2	3	3	4	3	3	4	3	3	2	3	2	3	3
24	2	2	2	3	3	4	4	4	4	4	5	5	5	5	5	6	7	7	6	6	5	5	4	3	5
25	4	5	7	7	7	8	7	7	6	5	6	6	6	5	7	8	7	7	7	7	6	5	4	4	6
26	4	5	6	5	4	3	2	2	1	2	3	3	2	3	3	4	4	4	3	3	3	1	1	1	3
27	2	2	3	2	2	3	4	4	4	4	4	4	4	5	6	5	5	7	5	4	3	5	6	5	4
28	4	2	2	2	4	4	2	1	2	3	3	3	4	5	5	6	6	6	6	5	5	4	3	1	4
29	1	1	2	2	2	2	2	2	2	2	3	3	3	2	4	3	4	4	4	4	3	3	2	1	2
30	1	1	2	2	3	4	4	3	3	3	3	2	2	2	3	3	4	3	4	3	3	3	2	1	3
31	1	2	2	3	3	3	3	3	3	3	4	2	2	2	[illegible]	3	3	2	[illegible]	3	2	2	1	0	2
HOURLY MEAN	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	3	3	3	2	

MAXIMUM= 7,6 MINIMUM= 0,4 MEAN = 3,3

744, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	4,0	6,3	6,3	4,5	4,0	4,0	4,0	4,9	4,5	5,4	7,6	4,9	5,8	6,3	3,6	
MIN	0,9	1,3	2,2	0,4	0,9	1,8	1,8	1,3	1,3	1,8	1,8	1,8	1,8	2,7	0,9	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	4,5	4,5	5,8	6,7	4,5	5,8	5,8	3,6	7,2	7,6	5,8	6,7	6,3	3,6	4,0	3,6
MIN	1,3	0,4	1,3	2,7	2,2	1,3	0,9	1,8	2,2	3,6	0,9	1,8	1,3	1,3	1,3	0,4

MEAN MAXIMUM= 5,2 MEAN MINIMUM= 1,5

Table N'2

Wind Direction for July 1975

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	185	130	155	190	220	190	180	175	185	210	330	80	68	70	60	65	70	75	85	95	160	200	225	275	153
2	265	230	230	235	220	225	220	240	275	275	320	325	330	330	320	325	330	320	310	300	295	270	250	250	279
3	265	270	280	270	300	300	330	335	310	320	330	340	320	320	320	320	330	320	320	325	330	325	305	310	312
4	5	85	90	150	190	220	190	145	145	90	80	70	65	70	60	50	55	50	55	330	340	330	270	250	141
5	320	270	240	240	220	250	250	255	320	50	40	50	40	50	40	45	60	65	90	95	175	180	165	185	155
6	190	190	195	200	210	210	210	210	220	225	210	200	210	210	220	240	180	90	95	120	120	150	180	185	186
7	190	200	210	200	210	210	220	240	240	240	240	240	240	140	80	70	85	60	60	110	140	155	185	190	173
8	210	230	220	220	250	220	230	240	245	245	320	310	300	300	300	290	280	275	270	275	270	220	195	165	253
9	195	195	195	210	220	180	10	30	30	20	15	15	30	15	340	345	300	280	280	270	260	220	180	195	168
10	165	165	165	180	165	180	210	165	170	180	195	195	210	200	250	270	230	165	150	180	175	190	200	310	194
11	330	330	340	330	330	330	330	345	315	315	315	315	320	300	270	270	285	280	285	285	285	270	220	180	299
12	170	150	150	150	160	165	150	150	160	165	150	150	140	120	45	45	45	60	60	60	90	90	90	100	117
13	110	135	150	150	165	165	180	165	165	165	150	150	150	150	160	150	140	140	140	135	135	150	165	160	151
14	220	180	150	180	195	195	195	200	210	220	210	225	210	225	285	285	285	300	270	240	285	285	280	270	233
15	210	180	165	165	180	165	165	165	165	165	170	195	200	230	330	345	15	15	30	30	45	75	90	105	150
16	135	135	150	150	135	150	150	165	165	165	165	200	220	270	330	340	345	15	30	45	50	100	130	135	161
17	135	150	165	165	180	180	165	165	165	180	195	225	275	285	285	290	300	300	290	315	0	0	0	0	184
18	165	165	200	195	190	195	180	190	195	195	190	180	180	190	210	210	210	220	250	270	260	250	180	195	203
19	210	200	195	200	195	180	210	195	195	200	210	210	225	240	240	270	220	240	240	265	225	210	195	200	215
20	195	210	200	195	200	210	195	195	195	195	200	195	210	200	230	230	240	255	240	225	260	260	240	210	216
21	195	200	195	210	225	225	225	225	210	225	225	285	285	285	285	300	300	290	285	285	280	285	285	225	251
22	90	135	135	150	165	165	165	165	165	165	180	225	285	290	300	290	285	285	270	270	270	270	225	195	214
23	180	195	180	165	180	165	190	195	195	195	210	225	225	260	300	315	330	345	345	30	45	75	90	105	198
24	135	165	170	195	195	195	195	210	210	200	200	210	210	250	260	270	270	270	270	270	270	270	260	240	225
25	230	280	315	315	315	330	330	330	330	330	315	315	315	310	285	285	285	285	285	285	285	15	20	15	267
26	15	15	15	30	30	40	45	105	135	135	150	130	100	110	20	15	15	15	345	330	345	350	60	105	111
27	135	150	150	150	165	165	170	180	190	195	195	210	210	230	250	255	225	225	220	240	255	255	255	280	206
28	285	315	315	345	15	30	45	140	195	195	225	255	260	270	285	265	285	270	270	285	285	270	270	270	236
29	200	170	165	135	150	135	150	140	165	150	150	150	120	110	30	45	45	45	45	45	45	45	60	60	106
30	105	135	135	135	165	150	165	165	165	165	165	180	180	180	15	30	30	30	30	30	45	45	60	90	108
31	135	135	135	150	150	165	165	165	165	165	165	190	210	240	300	320	345	345	345	345	345	345	345	0	224
OURLY EAN	180	184	186	192	190	190	188	193	200	192	200	201	205	208	216	221	207	191	202	206	205	199	184	176	

MAXIMUM= 350,0 MINIMUM= 0,0 MEAN = 196,5
744, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	330,0	330,0	340,0	340,0	320,0	240,0	240,0	320,0	345,0	310,0	345,0	170,0	180,0	300,0	345,0	
MIN	60,0	220,0	265,0	5,0	40,0	90,0	60,0	165,0	10,0	150,0	180,0	45,0	110,0	150,0	15,0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	345,0	315,0	270,0	270,0	260,0	300,0	300,0	345,0	270,0	330,0	350,0	280,0	345,0	200,0	180,0	345,0
MIN	15,0	0,0	165,0	180,0	195,0	195,0	90,0	30,0	135,0	15,0	15,0	135,0	15,0	30,0	15,0	0,0

MEAN MAXIMUM= 295,5 MEAN MINIMUM= 90,2

Table N'3

Wind Speed in meters per second for August 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	1	2	2	2	3	2	3	3	3	3	3	3	2	2	2	3	3	3	3	2	2	2	1	1	2
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
3	2	1	1	2	3	2	1	1	1	3	2	3	4	5	2	3	3	3	4	3	3	4	4	4	3
4	3	3	3	2	3	2	2	3	2	1	1	2	2	2	3	4	3	2	2	2	2	1	2	2	2
5	2	2	2	2	2	3	2	2	2	2	2	2	3	4	3	4	4	3	2	2	2	1	1	1	2
6	1	2	6	6	7	6	8	8	7	6	4	3	5	6	6	7	7	6	6	6	6	6	4	4	6
7	2	2	2	2	1	1	1	2	4	4	4	4	4	4	4	4	4	4	2	1	1	1	2	1	3
8	1	3	3	3	3	2	3	2	2	2	3	3	3	4	4	3	3	3	4	3	2	1	2	2	3
9	4	3	3	3	3	3	3	4	3	3	3	4	4	5	6	5	4	4	4	4	3	2	3	2	4
10	3	3	3	3	3	3	4	4	3	3	4	4	6	5	6	6	5	4	4	3	2	1	3	4	4
11	3	4	3	3	3	2	3	3	2	3	3	4	3	4	5	5	4	4	4	4	2	2	2	2	3
12	2	0	0	2	2	1	2	2	2	2	2	3	3	4	3	4	3	2	2	2	2	2	1	2	2
13	3	3	4	3	3	3	3	4	4	4	3	5	3	3	3	4	5	5	4	3	3	4	4	3	4
14	3	3	3	4	6	5	5	5	4	3	3	4	3	3	3	3	3	3	2	2	1	1	1	1	3
15	1	1	2	1	1	2	1	3	2	3	2	2	3	3	3	3	4	5	3	2	3	4	3	3	2
16	3	****	2	2	1	1	1	1	2	4	4	3	3	3	3	2	2	1	0	0	1	1	2	2	2
17	2	3	2	2	3	3	2	3	4	6	7	6	6	6	5	4	4	3	3	3	3	3	4	5	4
18	7	6	6	4	3	2	3	2	3	3	4	4	4	3	3	4	3	2	1	1	2	2	2	2	3
19	1	2	2	3	3	2	3	2	2	3	4	4	4	4	3	3	2	1	1	2	2	5	5	4	3
20	4	4	3	3	4	4	3	3	3	3	4	4	4	4	4	4	3	2	1	2	2	2	2	3	3
21	2	2	3	3	3	4	4	4	4	4	4	4	3	2	2	1	1	5	3	2	2	2	3	2	3
22	1	4	6	6	6	4	4	4	4	4	4	4	3	1	1	1	1	0	1	1	0	4	3	4	3
23	3	2	2	3	3	3	3	4	4	3	2	2	3	2	3	4	3	2	3	4	4	4	3	4	3
24	4	4	4	4	4	4	4	3	4	4	3	2	2	1	2	4	3	4	3	3	2	3	3	4	3
25	4	4	4	4	4	3	3	3	4	4	4	5	5	5	6	5	5	4	3	3	6	2	1	2	4
26	4	3	2	3	3	3	3	3	4	4	4	4	7	4	5	4	4	3	2	2	3	3	3	3	3
27	3	2	3	2	2	2	3	3	3	3	2	3	4	4	4	3	3	1	1	2	2	3	3	3	3
28	3	3	3	4	4	3	3	4	4	4	4	2	2	4	4	3	3	3	3	2	3	3	3	4	3
29	4	4	4	4	4	4	4	4	4	4	3	3	4	3	4	3	2	4	4	3	3	3	4	1	3
30	1	2	2	2	2	2	2	2	1	0	0	2	3	3	2	2	3	3	3	3	4	5	4	3	2
31	3	3	3	2	3	4	4	3	3	6	6	6	7	5	5	7	7	8	8	6	8	6	7	6	5
OURLY EAN	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	3	3	3	3	3	3	3	3	

MAXIMUM= 8,0 MINIMUM= 0,4 MEAN = 3,1

719, VALID OBSERVATIONS (96,6%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	3,1	*****	4,9	3,6	4,5	8,0	4,5	3,6	5,8	6,3	5,4	3,6	5,4	6,3	4,9	
MIN	1,3	*****	0,9	0,9	0,9	0,9	0,9	0,9	1,8	1,3	1,8	0,4	2,7	0,9	0,9	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	4,5	7,2	7,2	4,9	4,5	5,4	6,3	4,5	4,5	6,3	7,2	3,6	4,0	4,0	4,9	7,6
MIN	0,4	1,8	1,3	1,3	0,9	0,9	0,4	1,8	1,3	1,3	2,2	0,9	1,8	1,3	0,4	2,2

MEAN MAXIMUM= 5,2 MEAN MINIMUM= 1,2

Table N'4

Wind Direction for August 1975

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	170	165	165	165	150	160	165	165	165	165	165	165	195	195	15	30	30	15	345	345	30	45	60	60	139
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
3	300	300	195	180	150	165	150	150	225	225	210	225	225	280	230	255	270	255	160	180	195	195	195	180	212
4	195	195	195	195	195	195	195	250	225	245	250	315	315	330	315	315	315	285	285	275	235	210	195	195	247
5	195	195	195	195	195	195	165	190	180	220	220	250	325	345	345	40	180	105	45	130	165	150	150	150	189
6	180	140	45	45	50	50	50	45	45	70	105	90	80	45	50	50	45	45	45	45	45	60	100	105	68
7	135	135	120	135	150	150	145	150	45	45	45	45	45	40	30	40	45	30	45	40	160	170	175	165	96
8	175	165	180	180	165	165	195	195	220	240	285	315	335	345	345	15	15	30	30	30	45	115	135	150	170
9	150	150	165	165	170	180	185	195	195	195	220	240	285	285	285	285	285	275	270	255	255	210	195	195	220
10	225	210	195	210	210	225	225	220	220	225	260	275	280	280	280	270	285	285	285	260	240	210	195	200	240
11	195	210	210	200	195	195	195	195	195	225	225	225	225	280	285	285	285	275	285	285	230	150	165	165	224
12	150	300	210	210	210	195	225	225	225	210	270	285	300	300	330	315	315	345	30	45	120	135	135	150	218
13	180	195	210	195	195	180	165	165	180	195	195	300	160	190	220	250	260	270	245	235	225	205	210	210	210
14	195	210	225	270	15	30	30	30	30	45	45	30	30	30	345	345	330	345	340	340	330	315	330	160	183
15	160	160	145	165	165	150	135	150	155	135	135	150	150	150	135	135	120	110	100	75	75	90	85	120	131
16	150	****	90	150	165	220	240	225	180	30	15	30	345	345	335	330	315	285	0	0	200	200	210	195	185
17	180	195	195	195	195	225	250	270	285	285	285	285	270	260	270	270	265	240	225	225	225	225	245	315	246
18	15	20	15	35	45	45	30	20	345	335	330	325	15	30	315	285	285	270	195	135	150	65	85	105	146
19	135	110	135	135	150	150	150	135	55	60	60	70	90	45	45	60	60	90	60	30	15	15	15	15	79
20	15	20	30	45	45	60	120	105	50	45	30	30	30	30	30	30	30	60	135	135	135	140	155	160	69
21	165	165	160	180	175	180	180	195	180	180	195	210	210	195	245	300	0	340	240	235	235	225	225	225	203
22	0	270	285	285	285	305	300	330	345	345	15	30	45	45	0	330	335	0	0	0	0	105	105	105	161
23	125	150	150	150	150	150	150	135	150	155	135	110	105	135	90	45	60	60	150	165	180	195	210	225	139
24	210	210	225	210	225	225	210	210	135	90	95	130	135	****	210	225	210	210	220	220	225	195	195	195	192
25	195	195	210	210	195	210	210	210	240	245	235	240	230	230	240	225	225	225	225	240	315	190	180	180	221
26	265	225	175	195	180	210	195	225	285	300	300	320	345	345	330	295	285	270	240	225	225	210	195	210	252
27	210	200	210	220	225	240	345	345	345	335	315	275	275	300	300	285	285	295	180	165	180	165	165	165	251
28	165	165	165	165	165	165	175	180	180	180	185	180	120	30	45	45	60	85	105	125	135	150	150	150	136
29	150	165	165	165	165	165	180	195	235	240	210	210	205	225	240	195	155	180	195	195	195	210	330	150	198
30	150	165	165	210	210	210	195	195	225	0	0	90	105	100	90	80	75	90	105	90	90	105	105	100	123
31	105	135	120	130	135	150	135	130	150	155	160	150	165	150	150	150	155	150	150	155	165	165	165	175	148
OURLY EAN	161	177	166	173	164	172	176	181	190	181	173	187	188	192	205	193	187	184	165	163	167	161	169	163	

MAXIMUM= 345,0 MINIMUM= 0,0 MEAN = 176,5
718, VALID OBSERVATIONS (96,5%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	345,0	*****	300,0	330,0	345,0	180,0	185,0	345,0	285,0	285,0	285,0	345,0	300,0	345,0	165,0	
MIN	15,0	*****	150,0	195,0	40,0	45,0	30,0	15,0	150,0	195,0	150,0	30,0	160,0	15,0	75,0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	345,0	315,0	345,0	150,0	160,0	340,0	345,0	225,0	225,0	315,0	345,0	345,0	185,0	330,0	225,0	175,0
MIN	0,0	180,0	15,0	15,0	15,0	0,0	0,0	45,0	90,0	180,0	175,0	165,0	30,0	150,0	0,0	105,0

MEAN MAXIMUM= 280,3 MEAN MINIMUM= 81,0

Table N'5

Wind Speed in meters per second for September 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	6	5	5	6	5	4	2	3	3	3	3	3	2	4	3	3	1	2	3	2	3	3	3	2	3
2	2	3	3	2	2	2	3	3	3	4	4	6	4	4	5	6	7	8	7	7	7	7	6	5	5
3	4	4	3	3	2	2	2	2	1	2	2	3	3	2	2	3	2	3	2	1	2	3	2	2	2
4	2	2	3	5	7	7	6	6	6	5	5	4	5	5	5	5	4	3	3	2	3	4	4	3	4
5	3	2	2	2	2	2	2	3	3	4	3	3	2	1	4	4	4	3	2	2	1	2	2	3	2
6	3	4	10	10	9	8	7	7	6	6	6	6	6	6	6	5	4	4	3	2	2	3	3	3	5
7	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	3	2	2	2	3	4	4	3
8	4	5	5	4	4	4	4	4	4	4	5	5	6	6	5	5	6	6	7	7	7	7	6	6	5
9	8	7	6	4	4	4	4	4	4	4	4	4	4	4	3	4	2	3	2	1	3	3	2	3	4
10	2	3	3	3	2	3	3	3	4	4	4	4	3	3	4	4	4	3	1	2	3	3	3	4	3
11	5	4	4	4	4	5	5	5	6	5	6	6	6	7	7	6	6	5	5	5	4	4	3	6	5
12	9	8	7	8	8	8	8	7	6	6	7	6	6	6	6	6	6	6	8	7	5	6	8	8	7
13	7	6	6	6	6	7	6	6	7	8	8	7	6	10	10	10	10	8	8	7	7	8	7	7	7
14	6	5	5	4	4	4	2	2	2	1	2	3	3	3	3	4	3	3	3	2	1	2	3	2	3
15	2	3	4	2	4	4	3	3	3	4	4	4	4	4	4	3	3	4	3	2	2	2	2	3	3
16	3	3	3	4	3	4	3	3	3	3	4	4	4	4	4	3	3	3	2	2	2	1	1	2	3
17	2	1	2	1	2	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4	2	2	3
18	7	2	3	4	4	3	4	4	4	4	4	5	5	5	5	6	8	7	7	7	7	5	6	5	5
19	4	4	3	3	2	2	2	2	2	2	3	3	4	4	4	3	3	3	4	3	2	1	1	3	3
20	4	4	5	4	2	2	6	7	4	4	5	4	4	4	4	4	5	4	4	3	2	2	2	3	4
21	4	6	6	4	4	4	4	4	4	5	5	6	6	6	4	4	4	4	4	4	4	3	3	3	4
22	4	4	4	4	4	4	3	4	4	4	4	5	4	4	4	3	4	3	3	2	2	1	2	2	3
23	2	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	2	3	2	2	2	2	2	2	2
24	3	3	4	4	5	4	7	6	5	5	6	5	5	6	7	7	8	8	8	8	8	7	8	7	6
25	8	7	7	7	7	7	6	6	6	5	5	4	5	5	4	4	3	4	4	4	3	2	2	2	5
26	2	3	2	2	2	1	2	2	3	3	3	3	4	3	4	4	3	3	3	2	3	2	2	2	3
27	3	2	3	3	2	3	3	3	4	3	3	3	4	5	5	6	5	5	5	4	4	3	3	3	4
28	3	3	3	3	3	3	2	3	3	3	2	4	4	6	5	5	5	5	3	2	1	1	2	2	3
29	3	2	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	2	2	1	2	3	3	3
30	4	4	4	4	3	3	3	3	3	3	4	4	4	6	8	7	5	5	4	2	1	2	2	3	4
OURLY EAN	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	4	4	4	3	3	3	3	4	

MAXIMUM= 10,3 MINIMUM= 0,9 MEAN = 3,9
720, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	6,3	8,0	4,5	7,2	4,0	9,8	4,5	7,2	7,6	4,5	7,2	9,4	10,3	6,3	4,5
MIN	1,3	1,8	1,3	1,8	0,9	2,2	2,2	3,6	1,3	1,3	3,1	5,4	5,8	1,3	1,8
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	4,5	4,0	7,6	4,5	7,2	5,8	4,9	2,7	8,5	7,6	4,0	5,8	5,8	3,6	7,6
MIN	1,3	1,3	1,8	1,3	1,8	2,7	1,3	1,8	2,7	1,8	1,3	2,2	1,3	1,3	1,3

MEAN MAXIMUM= 6,2 MEAN MINIMUM= 2,0

Table N'6

Wind Direction for September 1975

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	175	175	165	165	165	180	195	165	190	180	180	180	210	215	240	315	240	165	210	195	195	195	195	175	194
2	225	315	300	230	210	225	230	230	240	250	275	300	315	330	315	345	345	345	345	345	345	15	15	30	255
3	30	20	45	45	50	165	175	160	120	75	50	15	15	30	25	15	150	150	30	100	135	135	155	185	86
4	165	210	300	330	335	345	345	340	345	345	335	330	315	320	330	345	345	330	320	330	345	15	15	20	281
5	15	150	155	140	180	165	180	180	180	140	115	150	150	200	135	120	135	135	140	150	0	90	175	[illegible]	141
6	225	230	285	290	310	315	315	315	310	315	300	285	285	275	275	270	270	255	225	210	195	195	[illegible]	195	264
7	190	165	165	170	170	180	165	180	195	210	210	210	200	210	210	180	210	210	195	195	195	195	210	205	193
8	210	210	210	210	210	210	210	225	225	255	270	280	285	285	305	300	300	315	330	345	330	335	340	340	272
9	15	15	15	20	20	30	15	15	335	330	330	330	330	330	315	330	315	300	315	240	210	195	180	180	196
10	165	165	180	180	165	165	165	165	180	180	180	195	210	210	180	190	190	210	150	135	150	160	180	180	176
11	175	175	180	175	180	180	180	185	195	195	210	210	210	210	210	205	205	205	205	210	210	210	195	270	199
12	345	330	330	345	345	345	350	335	335	330	320	325	330	325	320	315	315	295	300	300	315	315	330	330	326
13	330	330	315	320	315	315	315	315	315	310	300	275	270	305	300	300	310	315	315	310	315	315	330	330	311
14	330	335	340	340	335	330	225	180	180	195	300	330	315	315	345	335	15	15	45	45	60	135	135	135	221
15	150	165	165	165	165	180	165	165	165	165	180	195	195	210	210	195	195	185	180	175	195	180	175	175	179
16	180	195	195	200	165	165	180	180	185	190	195	195	195	195	195	195	195	210	240	315	335	285	225	225	210
17	210	195	195	165	165	165	180	165	165	140	140	105	95	45	45	45	50	65	90	90	105	90	105	110	122
18	120	135	140	165	165	140	135	135	120	120	135	135	150	155	155	155	165	160	165	175	175	175	180	185	152
19	195	185	210	195	195	220	225	215	215	225	225	225	220	220	220	210	240	210	195	195	210	195	190	180	209
20	195	195	195	230	215	195	300	315	320	315	300	275	285	285	285	300	300	300	300	300	225	165	165	180	256
21	240	270	260	250	225	225	220	225	215	210	225	240	240	255	250	255	235	225	225	235	225	225	225	225	234
22	225	225	235	230	225	225	225	205	205	225	225	235	235	245	255	255	265	255	240	230	225	210	195	210	229
23	210	215	220	225	210	225	225	275	210	210	210	255	305	315	340	15	25	25	45	45	85	90	90	100	172
24	105	90	105	105	90	100	60	60	95	90	60	90	95	80	60	50	45	45	50	60	90	100	90	90	79
25	100	100	95	100	100	90	90	90	90	90	90	90	90	90	90	60	60	45	50	75	90	135	150	180	93
26	210	225	210	210	210	175	225	225	225	225	225	240	240	245	250	240	240	250	235	255	280	240	225	225	230
27	225	225	225	225	225	225	225	255	345	330	315	305	285	285	285	300	285	280	275	275	270	225	225	225	264
28	225	210	210	210	210	210	210	195	195	210	225	270	270	285	285	285	285	285	275	265	230	180	150	165	231
29	165	165	165	150	150	150	165	150	165	165	180	180	180	180	190	190	190	205	190	180	180	195	195	210	176
30	195	195	195	225	180	180	195	195	195	195	210	225	245	280	285	280	285	285	285	275	180	150	150	180	219
OURLY EAN	185	194	200	200	196	201	203	200	215	214	217	223	226	231	230	220	214	209	206	209	203	178	180	188	

MAXIMUM= 350,0 MINIMUM= 0,0 MEAN = 205,8

720, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	315,0	345,0	185,0	345,0	210,0	315,0	210,0	345,0	335,0	210,0	270,0	350,0	330,0	345,0	210,0
MIN	165,0	15,0	15,0	15,0	0,0	195,0	165,0	210,0	15,0	135,0	175,0	295,0	270,0	15,0	150,0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	335,0	210,0	185,0	240,0	320,0	270,0	265,0	340,0	105,0	180,0	280,0	345,0	265,0	210,0	285,0
MIN	165,0	45,0	120,0	180,0	165,0	210,0	195,0	15,0	45,0	45,0	175,0	225,0	150,0	150,0	150,0

MEAN MAXIMUM= 272,5 MEAN MINIMUM= 129,0

Table N'7

Wind Speed in meters per second for October 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	4	4	5	5	4	4	5	5	5	5	4	4	6	5	4	5	5	5	5	5	4	5	5	5	5
2	6	7	8	10	8	8	8	8	8	7	8	7	7	6	6	5	7	7	8	8	7	7	6	5	7
3	4	4	3	3	3	3	4	4	4	4	4	4	5	5	5	5	5	4	4	4	3	3	4	4	4
4	4	3	3	4	4	4	3	3	3	3	3	3	4	5	5	5	4	4	4	3	1	2	3	3	3
5	3	4	4	3	3	3	3	3	3	4	4	4	4	4	5	5	3	4	5	4	4	4	4	5	4
6	5	5	5	5	4	5	5	3	4	4	4	6	7	7	6	6	6	5	6	5	4	4	4	2	5
7	3	4	4	3	2	2	1	2	2	2	2	2	2	2	3	4	4	3	3	2	2	2	2	2	2
8	2	2	2	3	2	3	4	4	2	2	3	2	3	4	4	5	4	4	5	5	3	3	3	3	3
9	2	2	3	3	3	4	2	3	4	3	3	3	3	2	2	2	5	4	4	4	4	3	2	3	3
10	2	3	2	3	2	2	2	2	3	4	4	4	4	3	4	5	6	4	4	3	1	2	3	3	3
11	4	4	4	4	4	4	4	3	3	4	4	4	4	4	6	6	6	7	6	6	6	5	6	5	5
12	6	5	6	6	6	6	7	7	7	7	7	7	6	5	4	4	4	4	3	1	1	1	2	2	5
13	3	3	2	3	3	3	3	4	4	4	4	4	4	5	5	5	5	4	4	4	3	4	4	4	4
14	4	4	4	4	3	4	3	4	4	4	4	****	****	****	****	****	****	****	****	****	****	****	****	****	4
15	****	****	****	****	****	****	****	****	****	****	****	8	8	6	6	6	6	5	5	3	4	4	4	6	5
16	8	8	8	7	6	5	4	4	3	4	4	4	4	5	4	4	3	2	1	1	2	2	3	2	4
17	2	2	2	4	4	4	4	4	3	4	4	5	5	6	5	6	6	7	8	8	9	9	10	9	5
18	10	9	9	10	9	9	8	7	8	6	7	6	6	5	5	6	6	6	6	6	6	5	4	4	7
19	4	3	4	4	3	3	2	1	2	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	3
20	2	2	2	3	3	2	2	2	2	3	4	4	4	4	4	4	5	4	3	4	5	5	4	5	3
21	5	5	4	5	5	4	4	4	5	5	5	5	5	4	4	3	3	1	1	3	2	2	2	2	4
22	2	1	3	4	4	4	3	1	1	1	2	3	3	4	4	4	4	4	2	1	1	2	3	3	3
23	3	3	3	4	3	4	3	3	4	4	4	4	4	4	4	4	4	3	1	1	3	3	3	3	3
24	4	3	4	4	4	4	4	5	4	5	5	5	5	4	4	4	4	4	2	2	2	4	6	6	4
25	6	6	7	8	7	7	8	6	7	6	6	8	8	7	7	6	6	7	7	6	5	4	4	4	6
26	3	4	4	4	4	3	3	2	1	1	3	2	2	2	2	3	4	2	2	1	1	2	1	1	2
27	3	3	3	3	4	4	3	3	3	3	4	3	3	3	3	3	2	2	2	1	2	3	3	3	3
28	3	2	3	3	3	4	4	4	3	4	4	4	4	4	7	6	6	7	6	5	4	3	2	2	4
29	1	2	3	4	6	8	7	7	6	6	7	6	6	7	7	8	8	8	8	7	8	8	9	8	6
30	8	8	8	7	8	8	8	8	8	9	8	8	6	5	4	4	4	3	2	3	2	3	2	3	6
31	2	3	3	3	3	3	4	4	4	5	5	6	6	5	5	6	4	4	4	5	5	6	6	6	5
OURLY EAN	4	4	4	5	4	4	4	4	4	4	4	5	5	5	5	5	5	4	4	4	4	4	4	4	

MAXIMUM= 10,3 MINIMUM= 0,9 MEAN = 4,2
720, VALID OBSERVATIONS (96,8%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	5,8	9,8	5,4	5,4	5,4	6,7	4,0	5,4	4,9	5,8	6,7	7,2	5,4	4,5	8,5	
MIN	3,6	4,9	2,7	1,3	2,7	2,2	1,3	1,8	1,8	0,9	2,7	1,3	2,2	3,1	3,1	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	8,5	9,8	10,3	4,0	4,9	5,4	4,5	4,5	5,8	8,0	4,5	4,0	7,2	8,9	8,9	6,3
MIN	0,9	1,8	3,6	0,9	1,8	1,3	0,9	1,3	2,2	3,6	0,9	1,3	2,2	1,3	1,8	2,2

MEAN MAXIMUM= 6,3 MEAN MINIMUM= 2,1

Table N'8

Wind Direction for October 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
												HOUR													
1	195	210	210	210	210	210	210	210	210	225	215	240	270	315	300	305	315	315	315	330	330	330	325	330	264
2	335	335	345	360	360	5	5	15	15	15	15	355	345	345	335	310	335	330	330	335	330	330	335	330	256
3	315	315	230	210	195	195	195	210	225	210	220	230	245	255	255	275	270	240	240	225	210	210	210	210	233
4	210	210	195	195	195	195	195	195	210	195	210	225	270	270	285	285	265	285	285	280	240	165	165	150	225
5	150	155	150	165	175	175	165	165	165	165	175	180	185	210	210	210	275	210	215	205	195	195	205	195	187
6	210	210	210	210	210	210	215	210	225	240	250	270	285	275	275	275	280	275	270	270	270	305	15	40	229
7	30	30	45	45	85	150	165	165	165	165	185	165	135	40	30	45	45	45	55	60	90	90	110	135	95
8	135	135	150	165	165	155	165	165	135	90	150	150	120	45	60	65	80	90	90	90	90	95	105	90	116
9	110	120	135	105	90	95	90	105	140	140	150	135	135	125	140	235	285	285	285	270	255	240	225	225	172
10	195	210	195	195	225	230	215	180	195	195	190	205	210	240	270	275	285	285	285	270	215	180	165	175	220
11	165	180	195	195	210	210	210	215	225	315	305	300	295	290	315	315	300	300	300	300	300	315	315	315	266
12	315	330	320	315	315	330	335	335	345	345	345	350	350	350	345	325	330	335	345	345	300	210	210	160	317
13	165	165	165	175	165	165	195	195	210	210	195	195	195	205	210	210	205	205	225	225	210	205	210	210	196
14	210	210	225	210	195	220	215	225	225	225	240	****	****	****	****	****	****	****	****	****	****	****	****	****	218
15	****	****	****	****	****	****	****	****	****	****	****	270	275	270	275	275	275	270	270	225	225	225	225	255	257
16	315	320	315	320	315	315	315	315	315	315	315	290	285	295	290	305	300	275	270	210	195	195	180	165	280
17	155	135	120	105	105	105	105	105	105	90	90	85	90	90	90	90	90	60	60	75	60	60	65	75	92
18	80	65	85	75	75	75	75	90	90	90	90	90	90	90	90	75	90	85	90	65	90	90	90	95	86
19	90	90	90	105	90	90	150	0	180	195	195	190	195	210	210	195	220	220	230	240	205	165	180	165	163
20	175	195	195	205	210	210	195	195	175	205	225	235	240	270	260	245	230	215	195	195	200	210	195	195	211
21	195	205	210	220	225	210	205	205	205	210	230	245	245	285	280	295	285	0	0	215	210	265	225	215	212
22	230	****	240	270	270	275	280	285	180	205	195	180	25	45	50	60	55	60	75	90	135	165	175	185	162
23	185	200	195	200	195	195	195	185	185	185	195	195	205	205	210	210	205	210	30	110	160	160	160	165	181
24	165	165	165	165	165	165	165	165	165	175	180	195	180	185	195	185	180	180	165	165	165	165	165	165	172
25	165	165	175	165	175	170	175	180	185	210	220	270	275	275	275	270	270	285	275	275	280	275	270	270	231
26	260	325	325	330	330	330	345	330	225	0	345	15	30	20	20	30	15	30	55	110	135	120	0	0	155
27	150	150	165	150	150	150	165	155	165	165	180	180	235	240	315	330	345	55	90	90	135	165	165	180	178
28	180	185	180	180	180	190	175	180	190	205	210	210	270	300	285	270	285	275	255	240	210	215	200	210	220
29	210	225	265	270	330	350	345	10	10	10	10	10	10	10	10	10	10	355	350	345	345	345	345	355	189
30	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	30	25	150	155	150	165	180	46
31	165	160	165	180	170	180	180	165	175	180	180	180	170	185	180	180	170	180	180	165	175	175	180	180	175
OURLY EAN	183	187	189	190	193	185	189	172	175	173	191	195	196	199	203	206	211	200	195	206	204	201	186	188	

MAXIMUM= 360,0 MINIMUM= 0,0 MEAN = 192,3
719, VALID OBSERVATIONS (96,6%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	330,0	360,0	315,0	285,0	275,0	305,0	185,0	165,0	285,0	285,0	315,0	350,0	225,0	240,0	275,0	
MIN	195,0	5,0	195,0	150,0	150,0	15,0	30,0	45,0	90,0	165,0	165,0	180,0	165,0	195,0	225,0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	320,0	155,0	95,0	240,0	270,0	295,0	285,0	210,0	195,0	285,0	345,0	345,0	300,0	355,0	180,0	185,0
MIN	165,0	60,0	75,0	0,0	175,0	0,0	25,0	30,0	165,0	165,0	0,0	55,0	175,0	10,0	15,0	160,0

MEAN MAXIMUM= 266,3 MEAN MINIMUM= 104,7

Table N'9

Wind Speed in meters per second for November 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	7	7	7	6	6	7	6	7	6	7	6	7	8	6	6	5	4	4	5	6	5	4	4	3	6
2	4	5	4	3	2	3	3	3	3	3	4	4	4	4	4	3	4	5	5	5	4	4	4	4	4
3	4	4	4	5	5	5	6	6	7	6	5	4	4	4	4	3	1	3	4	4	4	3	3	3	4
4	3	5	6	5	5	7	7	6	6	6	5	4	5	5	5	5	4	4	3	3	3	2	1	3	5
5	5	5	4	4	4	3	3	3	3	2	3	6	6	6	4	4	3	2	1	2	2	2	3	1	3
6	2	3	4	3	3	3	4	3	3	3	3	3	3	3	3	2	2	1	1	1	1	2	2	3	3
7	2	3	3	3	4	4	4	3	4	4	4	4	5	5	6	5	4	5	4	4	5	4	4	5	4
8	4	5	4	5	4	4	5	4	5	4	4	4	5	6	7	7	6	5	4	1	2	1	2	3	4
9	2	2	3	2	3	3	4	4	4	4	5	5	5	4	4	4	4	4	3	3	4	4	4	5	4
10	6	5	4	5	5	6	7	7	7	7	8	9	13	13	13	11	11	10	10	8	9	10	11	10	9
11	10	9	5	4	4	4	4	3	3	3	3	2	1	1	2	3	3	2	3	4	4	3	3	2	4
12	1	2	4	6	5	4	4	4	4	4	3	4	4	3	3	7	4	5	8	10	10	10	9	8	5
13	7	5	5	5	5	4	3	3	3	3	4	5	4	3	4	3	4	4	11	10	10	10	10	11	6
14	11	11	11	11	11	13	12	12	13	11	11	10	10	10	9	9	9	9	8	9	8	8	7	6	10
15	6	6	6	3	4	4	4	5	5	5	5	6	6	6	7	7	7	5	5	5	4	4	4	5	5
16	6	6	4	4	5	5	4	2	2	2	1	2	3	3	2	1	1	1	1	2	3	3	3	3	3
17	4	4	4	4	4	4	3	3	3	4	3	3	4	5	5	4	3	2	3	3	4	4	3	4	4
18	4	3	3	3	3	3	3	3	3	3	4	5	4	4	4	4	2	1	1	2	3	3	4	3	3
19	4	3	3	4	3	3	4	4	3	3	3	3	3	3	3	1	0	1	2	3	3	3	3	3	3
20	4	3	3	4	4	4	4	4	5	4	4	5	5	5	5	4	4	6	7	6	6	5	6	7	5
21	9	8	6	4	3	3	4	4	5	5	7	6	7	6	6	6	5	5	7	7	7	4	5	9	6
22	9	10	9	9	8	8	8	7	6	5	6	6	6	6	6	6	5	5	4	4	4	4	4	4	6
23	3	3	3	3	3	4	4	3	3	3	4	4	5	6	5	4	3	2	1	2	2	3	3	3	3
24	2	3	3	3	3	3	2	2	3	2	2	4	3	3	3	3	4	4	6	4	4	5	3	3	3
25	1	2	3	3	2	2	3	3	4	4	4	4	5	4	4	4	4	4	5	5	5	3	4	4	4
26	5	4	4	4	4	3	4	4	4	4	5	4	3	3	2	3	3	3	3	4	4	4	5	6	4
27	4	6	8	9	10	7	6	6	8	8	6	7	7	7	7	6	5	5	6	6	5	6	6	6	7
28	6	6	6	5	5	5	5	4	4	4	4	5	4	4	4	4	4	4	3	3	3	3	2	2	4
29	3	3	3	3	4	4	6	5	6	5	6	5	5	8	6	7	7	6	7	8	8	8	7	8	6
30	8	7	8	8	8	9	8	8	8	8	9	9	8	8	8	10	8	8	9	8	12	12	12	13	9
OURLY EAN	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	

MAXIMUM= 13,4 MINIMUM= 0,4 MEAN = 4,8
720, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	7,6	5,4	7,2	7,2	5,8	3,6	5,8	6,7	5,4	13,4	10,3	10,3	10,7	12,5	7,2
MIN	3,1	2,2	1,3	1,3	1,3	0,9	1,8	1,3	1,8	4,0	1,3	1,3	2,7	6,3	3,1

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	5,8	4,9	4,9	3,6	7,2	9,4	9,8	5,8	5,8	4,9	5,8	10,3	5,8	8,0	13,0
MIN	0,9	2,2	1,3	0,4	3,1	2,7	3,6	0,9	2,2	1,3	2,2	4,5	2,2	2,7	7,2

MEAN MAXIMUM= 7,5 MEAN MINIMUM= 2,4

Table N'10

Wind Direction for November 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	180	195	195	195	195	195	200	205	195	200	205	225	230	240	245	235	220	225	240	250	245	240	225	225	217
2	240	255	240	230	215	205	205	205	195	200	210	210	215	240	245	270	215	210	205	215	210	210	200	195	218
3	205	230	220	215	225	240	245	250	245	250	255	240	250	240	250	240	250	290	250	240	240	220	210	190	237
4	210	240	240	250	250	260	250	250	250	250	250	260	260	250	270	260	240	220	240	270	240	210	220	240	245
5	250	250	250	250	250	220	220	220	270	220	240	270	270	280	300	280	280	290	280	240	220	210	190	120	243
6	170	190	180	190	180	170	180	180	180	180	190	200	220	290	290	310	30	50	80	90	110	150	160	150	172
7	150	170	170	170	170	170	170	180	180	180	180	180	190	190	210	190	180	180	190	200	200	200	190	190	183
8	200	200	200	200	190	190	190	190	190	200	220	230	240	270	270	270	280	270	260	250	230	220	210	180	223
9	180	180	170	180	180	210	230	200	180	180	180	180	190	180	180	180	180	170	150	140	130	140	150	160	175
10	160	170	180	180	170	160	160	180	180	180	180	240	250	250	240	240	240	240	240	240	250	270	270	280	215
11	290	290	220	220	210	220	220	220	200	180	190	210	****	****	360	360	30	50	90	100	100	110	130	130	188
12	130	140	170	160	170	170	160	180	190	180	180	180	210	210	240	270	270	260	270	280	280	270	280	260	214
13	300	290	260	220	220	220	230	240	220	220	230	220	230	230	220	220	230	220	360	360	360	360	360	360	266
14	360	360	360	360	360	360	360	360	360	360	360	340	330	330	340	330	330	320	310	310	310	310	310	320	340
15	310	310	300	190	210	210	210	210	210	190	210	210	210	210	210	210	200	210	210	200	200	200	210	230	220
16	240	240	240	240	230	280	310	320	190	190	210	270	310	310	340	360	360	0	130	120	150	180	190	190	233
17	190	190	190	190	190	190	190	210	200	210	220	240	240	300	300	300	270	240	220	210	220	220	220	210	223
18	210	210	220	210	210	220	230	230	230	230	260	270	270	270	280	270	270	270	240	210	210	210	210	180	234
19	180	190	190	180	180	180	180	180	180	180	180	190	210	300	310	300	310	0	170	170	170	180	180	180	195
20	180	180	180	180	180	180	170	170	160	160	170	180	180	180	170	170	160	160	160	160	170	170	190	190	173
21	280	280	270	240	220	190	200	210	220	210	240	250	220	270	260	240	240	240	240	230	230	240	240	270	239
22	300	300	320	320	320	320	320	320	320	300	290	280	270	270	270	270	270	270	270	220	220	220	220	220	279
23	220	220	210	220	210	210	210	****	230	230	230	240	270	280	300	300	300	300	280	190	180	170	170	160	232
24	170	170	160	160	160	160	150	150	150	150	150	130	120	100	80	80	90	90	100	110	110	110	100	100	127
25	100	90	80	100	90	150	200	190	200	200	220	220	240	240	240	240	240	230	220	220	220	210	210	220	190
26	220	220	210	210	220	220	210	230	230	220	210	220	220	200	180	140	150	120	100	90	100	100	100	130	177
27	120	130	140	170	170	200	220	230	240	240	240	240	250	250	250	250	250	250	230	230	230	230	230	230	218
28	230	230	230	230	230	230	230	220	220	220	220	220	220	220	220	220	220	220	220	210	210	210	190	180	219
29	170	170	170	170	170	170	180	190	170	170	170	180	180	180	180	170	180	180	180	180	180	180	180	180	176
30	180	180	180	180	180	190	190	190	190	190	190	210	210	210	180	180	180	190	190	270	270	270	270	270	206
OURLY EAN	211	216	212	207	205	210	214	218	211	209	216	225	231	241	248	245	222	199	211	207	207	207	207	205	

MAXIMUM= 360.0 MINIMUM= 0.0 MEAN = 215.9
717. VALID OBSERVATIONS (99.6%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	250.0	270.0	290.0	270.0	300.0	310.0	210.0	280.0	230.0	280.0	360.0	280.0	360.0	360.0	310.0
MIN	180.0	195.0	190.0	210.0	120.0	30.0	150.0	180.0	130.0	160.0	30.0	130.0	220.0	310.0	190.0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	360.0	300.0	280.0	310.0	190.0	280.0	320.0	300.0	170.0	240.0	230.0	250.0	230.0	190.0	270.0
MIN	0.0	190.0	180.0	0.0	160.0	190.0	220.0	160.0	80.0	80.0	90.0	120.0	180.0	170.0	180.0

MEAN MAXIMUM= 276.0 MEAN MINIMUM= 147.5

Table N'11

Wind Speed in meters per second for 1 through 10 December 1975

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	10	10	11	10	9	11	11	8	9	8	8	8	9	8	6	7	5	5	4	5	5	4	4	3	8
2	3	3	4	4	4	4	5	5	4	4	5	4	5	5	7	7	8	8	5	8	10	9	9	9	6
3	8	10	10	8	8	8	7	7	7	7	7	7	8	7	7	5	6	4	4	3	2	2	2	3	6
4	2	2	3	3	3	3	4	4	4	5	5	5	5	4	4	4	3	3	3	3	4	5	6	5	4
5	6	6	4	4	4	4	5	4	5	6	6	6	6	5	5	6	6	5	6	6	6	5	5	5	5
6	4	5	4	6	4	4	5	5	9	10	10	8	7	9	10	8	9	8	8	7	7	7	6	5	7
7	5	5	5	4	4	5	5	4	5	4	4	3	3	4	4	4	4	4	4	3	3	2	3	4	4
8	3	2	0	1	1	1	1	1	2	3	3	2	2	****	3	3	4	3	4	3	2	2	2	1	2
9	3	3	3	3	3	3	4	4	4	5	5	5	4	3	4	2	3	2	3	3	3	6	6	7	4
10	6	6	6	6	7	7	8	8	6	7	8	7	7	7	7	6	4	4	4	4	4	5	4	5	6
OURLY EAN	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	5	5	5	5	4	5	5	5	5	

MAXIMUM= 11,2 MINIMUM= 0,4 MEAN = 5,2
239, VALID OBSERVATIONS (99,6%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10
MAX	11,2	9,8	10,3	5,8	6,3	10,3	5,4	4,5	6,7	8,0
MIN	3,1	2,7	1,8	2,2	4,0	4,5	1,8	0,4	2,2	4,0

MEAN MAXIMUM= 7,8 MEAN MINIMUM= 2,7

Table N'12

Wind Direction for 1 through 10 December 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	270	260	270	270	260	260	260	260	260	250	260	260	270	270	260	270	270	270	260	260	260	260	240	230	261
2	220	230	230	220	210	210	220	230	240	240	230	230	270	270	270	270	280	280	260	270	280	300	290	290	252
3	290	290	290	290	290	290	280	280	280	280	280	260	300	300	300	300	300	310	310	310	290	230	180	190	281
4	210	210	180	190	170	170	170	170	170	170	160	160	160	150	130	130	130	140	120	120	150	180	170	170	162
5	170	170	170	170	170	180	180	180	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	185
6	190	190	190	190	190	200	210	220	240	360	360	360	360	360	360	360	360	360	360	360	30	30	40	50	247
7	80	90	90	100	110	110	110	110	110	110	110	110	120	****	50	80	90	100	100	100	100	100	100	100	99
8	100	100	0	0	90	60	120	120	100	140	130	110	110	****	60	60	80	90	90	90	90	90	90	90	87
9	120	120	120	120	120	140	140	140	140	140	170	160	160	160	160	160	220	240	240	220	220	270	280	280	177
10	280	280	280	280	310	310	310	310	310	310	310	310	310	310	300	300	270	240	240	230	230	240	240	230	281
HOURLY MEAN	193	194	182	183	192	193	200	202	204	219	220	217	225	251	208	212	219	222	217	215	184	189	182	182	

MAXIMUM= 360,0 MINIMUM= 0,0 MEAN = 204,0
238, VALID OBSERVATIONS (99,2%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10
MAX	270,0	300,0	310,0	210,0	190,0	360,0	120,0	140,0	280,0	310,0
MIN	230,0	210,0	180,0	120,0	170,0	30,0	50,0	0,0	120,0	230,0

MEAN MAXIMUM= 249,0 MEAN MINIMUM= 134,0

Table N'13

Wind Speed in meters per second for March 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
3	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
4	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
5	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
6	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
7	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
8	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
9	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
10	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
11	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
13	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
14	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
15	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
16	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
17	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
18	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
19	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
20	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
21	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
22	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
23	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
24	****	****	****	****	****	****	****	****	****	****	****	****	****	****	6	9	8	7	5	4	4	5	5	7	6
25	6	7	5	7	7	5	4	3	4	7	7	7	7	8	7	7	7	6	7	4	3	3	3	2	6
26	2	3	3	3	4	4	4	4	4	5	6	6	6	6	7	6	7	7	4	4	4	5	6	6	5
27	5	4	4	5	5	5	6	6	8	8	7	7	5	8	8	11	13	12	11	9	9	8	9	9	8
28	9	8	8	7	6	5	5	4	3	3	4	3	3	4	4	4	3	3	2	3	3	2	3	2	4
29	1	2	2	3	4	3	3	2	3	4	4	4	3	5	4	4	4	4	4	4	4	3	2	4	3
30	5	5	5	6	6	7	7	7	8	7	8	8	8	8	7	8	7	7	6	6	6	6	6	6	7
31	6	6	6	4	2	2	1	1	1	2	2	3	3	5	3	2	1	3	4	5	5	4	3	2	3
OURLY EAN	5	5	5	5	5	4	4	4	4	5	5	5	5	6	6	6	6	6	5	5	5	5	5	5	

MAXIMUM= 13,4 MINIMUM= 0,9 MEAN = 5,1
178, VALID OBSERVATIONS (23,9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
MIN	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	*****	*****	*****	*****	*****	*****	*****	*****	8,9	8,5	7,2	13,4	8,9	4,9	8,5	6,3
MIN	*****	*****	*****	*****	*****	*****	*****	*****	3,6	1,8	2,2	4,0	1,8	1,3	1,9	0,9

MEAN MAXIMUM= 8,3 MEAN MINIMUM= 2,6

Table N'14

Wind Direction for March 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
3	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
4	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
5	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
6	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
7	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
8	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
9	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
10	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
11	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
13	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
14	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
15	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
16	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
17	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
18	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
19	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
20	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
21	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
22	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
23	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
24	****	****	****	****	****	****	****	****	****	****	****	****	****	****	210	225	225	225	225	225	210	225	225	235	223
25	245	275	270	275	270	255	250	240	250	275	280	280	275	270	275	285	285	280	285	250	225	210	195	85	254
26	150	165	180	165	185	165	165	180	180	180	195	205	195	195	200	195	195	195	195	195	180	195	195	165	185
27	200	195	180	185	190	190	195	195	205	210	205	195	210	225	235	260	270	270	270	270	270	275	285	285	226
28	285	315	315	325	345	345	345	345	345	25	345	15	15	15	30	45	45	60	75	85	105	105	105	105	173
29	105	75	90	85	95	105	95	95	150	150	160	150	180	150	155	155	135	135	160	155	165	175	125	135	133
30	150	155	155	165	150	165	165	180	165	175	165	165	180	185	195	195	210	225	225	225	225	260	270	270	193
31	270	265	280	270	240	270	150	180	300	315	340	315	315	300	305	330	305	275	285	285	280	255	225	225	274
OURLY EAN	201	206	210	210	211	214	195	202	228	190	241	189	196	191	201	211	209	208	215	211	208	213	203	[illegible]	

MAXIMUM= 345,0 MINIMUM= 15,0 MEAN = 206,4
178, VALID OBSERVATIONS (23,9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
MIN	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	*****	*****	*****	*****	*****	*****	*****	*****	235,0	285,0	205,0	285,0	345,0	180,0	270,0	340,0
MIN	*****	*****	*****	*****	*****	*****	*****	*****	210,0	85,0	150,0	180,0	15,0	75,0	150,0	150,0

MEAN MAXIMUM= 268,1 MEAN MINIMUM= 126,9

Table N'15

Wind Speed in meters per second for April 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	3	3	3	2	2	3	3	5	4	6	4	6	5	5	8	7	7	5	6	5	6	6	5	5	5
2	4	5	5	6	5	6	6	6	6	6	5	6	6	7	6	6	6	5	5	5	4	3	1	2	5
3	2	2	2	3	3	3	2	2	2	2	3	4	4	4	5	5	4	4	4	4	4	5	5	4	4
4	5	7	8	8	8	9	8	8	8	9	8	7	8	5	3	3	5	8	9	9	8	7	7	5	7
5	4	2	3	3	3	4	3	4	4	7	8	8	8	6	7	6	6	5	4	4	3	4	3	4	5
6	5	5	5	4	3	5	4	1	1	1	1	3	4	5	5	4	4	4	3	2	1	2	2	2	3
7	2	2	1	1	0	0	0	2	3	4	4	4	4	4	3	2	2	2	2	3	5	6	7	6	3
8	4	3	4	4	4	4	3	4	3	4	4	5	4	5	5	4	4	4	6	5	7	7	7	6	5
9	5	4	4	3	3	4	4	4	4	3	4	3	4	4	4	4	3	2	2	3	2	2	3	2	3
10	3	2	3	3	3	3	4	4	5	7	7	8	8	8	7	6	6	4	3	2	2	3	3	3	4
11	5	6	2	4	9	11	11	9	10	10	9	9	10	9	9	9	9	9	8	9	9	9	10	9	9
12	10	10	9	8	8	7	7	5	5	4	4	4	5	5	6	6	5	5	3	3	3	3	3	3	5
13	3	3	4	3	4	4	4	3	4	5	6	6	7	7	7	6	5	4	2	2	3	3	3	4	4
14	4	4	4	4	4	3	4	3	3	3	4	4	5	5	3	2	1	1	1	2	3	4	4	4	3
15	4	5	4	5	5	5	6	6	5	5	4	5	6	7	5	7	5	2	2	3	4	4	4	4	5
16	4	4	6	8	5	3	2	3	4	5	6	8	7	7	6	4	3	1	0	1	3	2	3	3	4
17	3	3	3	3	3	3	3	4	3	4	4	5	5	4	3	1	1	2	2	1	0	0	0	3	3
18	3	3	4	4	4	3	4	3	3	4	4	4	3	2	2	2	2	2	1	2	2	3	3	4	3
19	4	4	4	4	3	3	4	3	4	6	7	7	6	6	5	5	3	4	2	2	2	2	1	3	4
20	1	1	1	1	4	2	2	3	3	3	4	4	4	5	5	5	6	6	3	3	3	3	3	2	3
21	2	2	1	2	4	4	4	4	3	5	3	2	4	3	3	3	3	2	4	4	4	4	2	4	3
22	5	4	4	4	4	7	6	6	6	7	9	9	8	8	8	8	6	4	2	4	7	6	5	2	6
23	1	3	5	6	5	4	4	5	5	4	4	4	3	2	3	2	3	2	2	1	1	1	2	3	3
24	3	3	3	4	4	4	4	3	3	4	5	6	7	7	6	7	7	8	7	7	8	7	7	6	5
25	7	7	6	5	4	6	6	5	7	6	7	7	8	10	8	8	6	6	7	7	8	8	9	9	7
26	12	10	11	9	9	9	9	8	8	7	7	7	8	7	8	9	9	9	8	8	8	7	7	6	8
27	7	7	7	7	7	6	7	7	7	7	6	7	8	8	8	7	7	6	7	6	7	7	7	6	7
28	3	4	4	5	6	5	4	4	5	5	5	6	5	6	7	8	7	7	6	5	4	4	4	4	5
29	3	2	2	2	2	2	2	2	4	4	2	3	4	4	6	6	6	5	4	4	1	2	3	3	3
30	3	3	4	3	4	3	3	3	2	2	2	3	3	4	4	4	4	3	4	2	1	1	1	3	3
HOURLY MEAN	4	4	4	4	4	4	4	4	4	5	5	5	6	6	5	5	5	4	4	4	4	4	4	4	

MAXIMUM= 12,1 MINIMUM= 0,4 MEAN = 4,6
720, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	8,0	6,7	5,4	8,9	8,5	5,4	7,2	7,2	4,9	8,5	10,7	9,8	7,2	4,9	6,7
MIN	2,2	1,3	1,8	3,1	2,2	0,9	0,4	3,1	2,2	2,2	2,2	2,7	2,2	0,9	1,8

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	7,6	5,4	4,5	7,2	6,3	5,4	8,9	5,8	8,0	9,8	12,1	8,0	8,0	5,8	4,0
MIN	0,4	0,4	1,3	1,3	0,9	1,3	1,8	0,9	2,7	3,6	6,3	5,8	3,1	1,3	0,9

MEAN MAXIMUM= 7,2 MEAN MINIMUM= 2,1

Table N'16

Wind Direction for April 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	195	195	210	210	180	195	195	225	240	265	240	285	265	270	285	275	275	270	255	255	260	260	255	240	242
2	250	270	300	280	315	305	325	330	330	330	320	315	315	315	300	300	300	285	285	285	285	240	210	210	292
3	185	210	195	185	185	195	195	180	170	45	50	50	65	60	75	75	75	85	90	90	90	90	90	90	118
4	75	75	85	75	75	70	70	65	60	60	60	45	30	45	345	315	290	330	340	345	340	330	345	345	176
5	335	305	225	225	225	225	225	225	225	270	270	270	285	270	275	275	270	270	255	225	225	225	225	255	253
6	270	270	265	255	225	265	300	0	90	150	240	330	300	285	295	270	275	285	285	285	240	315	185	160	244
7	225	210	180	165	0	0	0	30	45	45	60	45	45	45	30	35	35	45	15	15	360	15	15	35	71
8	45	60	45	45	45	45	45	35	30	15	20	20	20	15	10	345	340	345	345	345	345	345	350	15	136
9	35	45	45	45	40	30	20	15	360	360	360	350	345	345	330	330	320	300	280	285	240	225	225	225	215
10	215	225	225	210	215	195	205	225	270	275	270	270	275	275	275	270	270	255	240	225	225	255	255	305	247
11	270	300	270	275	345	355	360	360	360	360	350	345	345	345	345	340	340	345	345	345	345	345	360	360	338
12	360	360	360	360	15	360	10	360	350	345	340	315	315	300	275	275	275	270	255	225	210	205	200	200	273
13	210	220	225	225	225	215	225	240	280	280	280	285	285	285	285	270	275	270	255	200	210	195	195	195	243
14	180	180	180	180	180	150	180	185	215	240	285	300	285	300	300	305	25	30	120	155	160	195	195	195	198
15	195	195	195	210	210	205	220	210	210	225	230	230	225	245	285	285	280	300	285	240	210	210	210	225	231
16	225	225	275	285	270	240	215	215	255	275	270	270	270	270	285	285	285	310	0	215	195	195	195	205	239
17	205	195	195	195	185	180	195	210	210	245	300	285	285	300	315	330	30	60	90	90	0	0	0	165	178
18	165	180	180	165	180	180	165	195	240	285	285	300	320	25	30	45	60	70	90	125	165	165	165	180	166
19	225	225	225	190	180	205	205	225	270	285	285	285	285	285	285	285	265	295	270	225	225	225	225	300	250
20	315	45	70	360	285	305	65	75	60	60	60	60	60	75	75	75	90	95	85	90	75	90	75	95	114
21	90	75	60	60	135	150	135	165	165	210	180	360	230	225	150	125	180	180	210	165	165	210	180	180	166
22	195	195	195	210	210	270	260	270	270	270	270	270	275	275	275	270	280	270	210	195	240	240	310	210	247
23	235	270	275	285	285	300	355	345	345	335	345	345	345	345	330	345	30	30	30	40	110	105	60	105	233
24	90	55	120	105	135	135	135	90	60	75	60	60	60	60	60	60	60	65	75	75	70	75	65	70	80
25	65	90	90	90	75	60	60	60	45	60	60	60	60	60	60	65	65	60	55	40	30	40	30	25	59
26	15	15	15	15	10	15	345	345	345	340	335	330	345	330	330	315	315	315	315	330	330	330	330	315	251
27	315	320	315	325	315	330	325	315	315	315	315	300	285	305	315	315	315	300	300	285	285	285	295	315	309
28	300	270	270	275	280	285	300	315	295	295	285	275	275	280	275	275	275	280	280	280	270	255	265	255	280
29	240	270	270	210	195	195	210	220	290	345	345	345	315	300	300	285	285	275	275	275	250	210	195	195	262
30	190	180	180	165	155	165	155	165	175	165	210	90	75	45	30	45	30	60	75	90	0	0	165	150	115
DAILY MEAN	197	191	191	196	179	195	191	197	219	228	233	236	230	219	228	236	208	212	200	201	205	196	196	195	

MAXIMUM= 360,0 MINIMUM= 0,0 MEAN = 207,4
720, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	285,0	330,0	210,0	345,0	335,0	330,0	360,0	350,0	360,0	305,0	360,0	360,0	285,0	305,0	300,0
MIN	180,0	210,0	45,0	30,0	225,0	0,0	0,0	10,0	15,0	195,0	270,0	10,0	195,0	25,0	195,0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	310,0	330,0	320,0	300,0	360,0	360,0	310,0	355,0	135,0	90,0	345,0	330,0	315,0	345,0	210,0
MIN	0,0	0,0	25,0	180,0	45,0	60,0	195,0	30,0	55,0	25,0	10,0	285,0	255,0	195,0	0,0

MEAN MAXIMUM= 307,8 MEAN MINIMUM= 98,8

Table N'17

Wind Speed in meters per second for May 1976

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	3	3	3	3	3	3	3	3	3	3	4	3	2	4	4	4	4	3	3	3	3	4	4	1	3
2	3	3	2	3	3	3	3	4	5	4	5	4	3	4	8	8	8	9	10	7	6	8	8	8	5
3	6	7	6	5	4	5	5	9	8	9	8	9	10	10	11	8	8	11	8	10	8	8	8	8	8
4	7	8	8	8	7	8	7	7	7	6	7	7	7	8	8	8	5	4	4	2	2	3	4	5	6
5	5	5	5	4	5	5	6	7	7	8	8	9	8	8	9	10	10	10	9	8	7	8	9	9	8
6	8	8	7	7	2	1	2	3	3	2	2	2	3	5	5	5	7	6	5	7	7	7	7	6	5
7	5	4	6	5	8	7	7	7	6	6	4	4	3	3	4	4	4	4	6	6	6	6	7	7	6
8	6	4	4	3	5	4	4	4	5	6	6	7	7	7	7	7	6	6	6	4	2	3	3	2	5
9	3	4	4	4	3	4	3	4	4	6	7	8	8	7	6	7	7	6	4	3	2	3	3	3	5
10	3	3	4	4	3	4	3	4	4	5	6	8	7	6	5	6	4	3	2	0	2	3	3	3	4
11	4	4	4	4	4	3	3	3	3	2	2	2	4	6	8	6	8	6	7	8	7	5	5	7	5
12	7	6	5	5	7	7	6	6	[illegible]	4	4	4	4	5	5	5	5	4	4	2	1	2	2	2	5
13	3	3	3	4	4	4	4	4	4	5	4	4	4	3	4	5	5	6	4	4	3	2	2	4	4
14	5	7	6	5	5	5	6	5	4	5	4	3	3	3	3	4	2	3	2	2	2	2	3	1	4
15	2	2	1	2	2	2	3	2	3	3	4	4	4	3	4	4	5	4	4	5	4	4	3	2	3
16	1	1	2	3	3	4	4	4	4	5	4	4	3	3	4	5	4	4	2	1	1	2	1	4	3
17	4	4	4	4	4	3	3	2	4	4	5	4	5	5	4	4	4	4	3	4	3	4	5	7	4
18	10	10	9	9	9	10	11	10	9	8	8	8	7	6	8	8	7	6	6	4	4	4	6	6	8
19	6	7	7	7	8	8	8	8	9	9	8	8	10	10	10	9	9	9	8	7	7	7	4	4	8
20	3	3	5	5	5	4	4	3	3	4	7	5	6	6	8	9	8	9	8	8	7	4	4	2	6
21	3	3	3	4	4	2	1	2	3	7	7	5	5	5	7	6	5	5	3	3	2	3	3	3	4
22	4	4	5	6	4	3	3	4	4	4	2	4	4	4	4	4	5	5	4	5	5	5	4	2	4
23	1	1	1	1	1	1	1	1	2	4	4	4	4	3	3	3	3	3	4	4	4	5	5	6	3
24	6	2	1	3	3	4	4	3	4	4	4	4	5	4	4	4	3	4	4	3	3	2	3	3	3
25	3	3	4	3	2	1	1	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
26	4	4	3	3	2	3	3	3	2	2	3	3	3	3	3	4	4	4	4	4	2	1	1	2	3
27	3	2	2	2	2	3	3	2	2	3	4	3	4	4	4	4	3	3	3	3	1	1	2	3	3
28	3	3	4	3	4	4	4	4	4	5	6	6	5	4	5	5	6	4	4	3	3	3	3	4	4
29	4	4	4	4	4	4	4	4	4	4	6	5	4	4	4	4	5	4	4	4	3	3	2	4	4
30	3	3	3	2	3	3	2	2	3	4	3	3	4	4	5	4	4	4	4	4	3	2	3	3	3
31	4	4	3	3	3	4	4	5	4	4	4	4	6	7	8	7	7	5	5	3	1	1	1	0	4
HOURLY MEAN	4	4	4	4	4	4	4	4	4	5	5	5	5	5	6	6	6	5	5	4	4	4	4	4	

MAXIMUM= 10,7 MINIMUM= 0,4 MEAN = 4,6
744, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	4,5	9,8	10,7	8,0	10,3	8,0	7,6	7,2	8,0	7,6	8,5	6,7	5,8	6,7	4,9	
MIN	1,3	1,8	4,0	1,8	4,5	0,9	3,1	2,2	2,2	0,4	1,8	0,9	1,8	0,9	1,3	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	4,9	6,7	10,7	10,3	9,4	7,2	5,8	5,8	5,8	4,5	4,5	4,0	5,8	5,8	4,9	7,6
MIN	0,9	2,7	4,0	3,6	1,8	1,3	1,8	1,3	0,9	0,9	0,9	0,9	2,7	2,2	1,8	0,4

MEAN MAXIMUM= 7,0 MEAN MINIMUM= 1,8

Table N'18

Wind Direction for May 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	150	150	150	165	165	165	165	165	180	180	195	240	30	180	175	160	160	165	180	195	195	180	225	235	173
2	210	215	225	220	220	195	195	200	210	215	250	275	305	225	225	210	195	205	245	225	240	265	270	270	230
3	255	260	270	235	230	240	235	300	285	300	300	285	285	285	285	270	270	275	285	300	300	300	315	300	278
4	315	315	315	315	320	315	315	300	300	285	285	285	275	275	285	285	300	280	270	240	165	195	195	195	276
5	200	195	195	195	195	195	195	195	205	205	215	225	225	225	225	230	225	225	215	220	225	220	225	225	213
6	225	235	240	270	180	220	165	195	270	10	45	60	60	55	55	75	90	85	85	75	45	60	85	90	125
7	90	90	60	60	30	30	30	15	20	20	15	350	335	330	325	315	300	295	285	315	325	325	345	345	194
8	345	325	300	270	315	315	315	315	300	315	300	315	285	285	285	285	280	275	270	255	210	195	190	195	281
9	200	210	210	210	200	205	210	210	210	235	245	240	270	270	270	270	270	270	270	255	220	190	180	165	229
10	165	165	195	195	195	195	195	200	225	265	275	280	285	280	285	285	285	285	285	0	195	195	210	195	222
11	210	210	220	210	210	210	210	240	270	270	240	230	270	285	310	330	330	315	330	345	345	330	315	330	274
12	345	330	315	315	315	330	325	330	345	350	345	310	295	285	280	270	270	270	275	285	0	120	135	135	274
13	150	150	165	165	165	180	180	180	180	180	195	190	205	160	135	45	60	60	60	75	90	90	120	150	139
14	160	160	165	180	195	195	205	195	195	205	210	205	240	285	285	270	250	235	240	225	190	165	60	165	204
15	120	135	105	95	120	100	120	125	125	60	60	60	60	60	60	60	70	70	65	65	75	75	85	90	86
16	75	90	135	155	165	165	175	165	180	190	210	215	270	345	300	280	275	275	255	300	205	165	160	185	206
17	225	195	210	210	195	210	195	195	210	215	225	270	270	280	280	270	275	300	330	330	335	330	315	330	258
18	15	5	5	5	5	5	10	10	15	5	5	345	330	310	330	320	330	345	345	305	295	315	330	335	180
19	330	335	330	335	330	330	330	325	325	330	325	315	315	315	315	315	285	285	285	285	285	265	300	305	313
20	315	270	285	285	285	270	255	225	240	260	265	255	265	255	255	255	270	270	255	270	270	250	300	210	264
21	225	215	225	215	270	285	270	225	260	270	285	300	300	300	285	300	315	315	335	315	295	330	315	280	280
22	300	325	345	345	345	345	330	330	345	350	340	315	330	315	315	300	285	315	330	335	345	345	345	330	329
23	210	195	150	100	165	160	155	150	95	45	35	30	30	30	20	345	345	315	315	300	315	340	345	360	190
24	15	45	0	30	45	45	45	45	45	45	45	45	30	45	60	45	30	45	45	55	60	65	45	45	43
25	45	50	45	45	60	120	105	45	45	25	45	55	45	45	45	30	15	350	330	330	330	330	345	355	135
26	360	15	30	30	30	345	15	30	345	345	340	355	345	340	315	300	315	300	315	315	300	0	195	180	228
27	175	180	180	150	150	165	165	165	210	285	295	315	320	345	355	30	30	50	60	60	75	0	120	120	167
28	120	125	135	135	140	135	150	150	160	165	165	155	165	155	145	150	155	160	155	150	150	145	150	150	148
29	155	155	165	155	150	150	160	155	140	150	160	165	155	150	150	150	150	135	135	120	100	135	135	135	146
30	135	135	135	135	125	125	125	135	150	155	185	90	45	45	45	45	45	55	60	75	75	75	135	150	103
31	140	165	165	150	150	155	150	150	165	180	210	255	270	270	270	270	275	270	270	270	0	0	0	0	175
HOURLY MEAN	193	182	183	180	183	197	184	183	201	197	204	227	223	227	225	218	218	229	232	222	202	195	210	211	

MAXIMUM= 360,0 MINIMUM= 0,0 MEAN = 205,2
744, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	240,0	305,0	315,0	320,0	230,0	270,0	350,0	345,0	270,0	285,0	345,0	350,0	205,0	285,0	135,0
MIN	30,0	195,0	230,0	165,0	195,0	10,0	15,0	190,0	165,0	0,0	210,0	0,0	45,0	60,0	60,0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	345,0	335,0	345,0	335,0	315,0	335,0	350,0	360,0	65,0	355,0	360,0	355,0	165,0	165,0	185,0	275,0
MIN	75,0	195,0	5,0	285,0	210,0	215,0	285,0	20,0	0,0	15,0	0,0	0,0	120,0	100,0	45,0	0,0

MEAN MAXIMUM= 286,9 MEAN MINIMUM= 101,3

Table N'19

Wind Speed in meters per second for June 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	0	0	0	0	1	1	1	2	2	2	3	3	3	3	4	5	6	5	6	5	5	5	4	4	3
2	3	4	4	4	3	3	4	4	5	5	5	5	5	5	4	4	4	4	4	3	4	3	3	3	4
3	3	1	1	2	2	7	3	3	4	4	4	4	4	4	5	4	4	4	4	3	4	4	3	3	3
4	2	2	2	3	2	2	2	2	3	2	3	4	4	4	4	4	3	4	4	4	3	5	4	4	3
5	3	2	1	1	0	1	1	2	2	3	3	4	4	4	4	5	4	4	3	2	2	2	3	1	3
6	0	1	1	0	1	0	0	1	2	2	2	2	2	3	4	4	4	5	6	4	4	4	4	4	2
7	4	3	2	3	2	7	2	3	4	5	7	6	6	5	5	4	4	4	4	4	2	1	3	3	4
8	3	3	3	4	4	4	3	3	3	3	4	4	4	4	5	6	5	5	4	4	3	3	2	3	4
9	3	2	2	2	4	3	3	3	4	5	5	5	5	5	4	4	5	4	3	2	1	1	2	2	3
10	3	4	3	3	3	3	3	3	4	3	3	3	6	7	7	5	7	4	2	2	2	3	3	3	4
11	4	4	4	4	4	4	4	4	6	6	6	6	7	8	7	7	7	6	6	6	5	3	2	1	5
12	3	3	3	2	4	4	4	5	5	5	5	6	6	6	5	6	6	6	5	5	4	4	3	0	4
13	1	2	1	3	4	4	4	5	4	4	4	4	4	6	4	4	5	5	4	4	3	4	4	5	4
14	6	6	5	5	5	5	4	5	5	5	5	6	6	7	7	5	6	5	4	4	4	4	5	5	5
15	5	4	4	4	3	4	4	4	4	4	4	5	5	6	6	7	8	7	7	7	6	7	7	7	5
16	7	6	6	5	7	6	5	4	3	4	5	4	4	2	4	3	3	1	2	2	2	2	3	2	4
17	3	4	3	2	1	2	3	2	2	3	4	4	4	4	4	3	3	3	2	1	1	1	2	2	3
18	3	3	3	3	3	3	3	4	3	4	3	4	3	3	4	4	4	4	3	3	2	3	3	4	3
19	4	7	4	1	1	3	3	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4	5	5	4
20	5	4	4	4	4	5	6	6	6	5	5	5	4	4	4	3	3	3	3	3	3	3	3	4	4
21	4	5	5	4	4	4	4	4	5	5	4	4	4	4	4	4	3	3	3	2	1	1	1	1	4
22	1	2	2	2	2	2	3	3	3	4	3	3	4	4	4	4	4	4	4	4	3	1	1	1	3
23	1	1	2	2	2	3	3	3	2	2	1	3	3	3	3	3	3	4	2	1	1	2	2	1	2
24	3	2	2	3	2	2	3	3	2	3	3	2	2	4	4	5	6	5	5	5	6	6	7	7	4
25	7	6	6	7	8	7	8	7	7	7	6	7	7	7	6	6	5	5	5	4	3	2	3	3	6
26	3	3	3	3	3	3	3	3	3	4	5	6	5	6	5	6	6	6	5	4	3	3	3	3	4
27	3	4	2	3	3	3	4	4	4	5	4	4	4	4	4	5	5	4	3	2	2	2	3	3	4
28	3	4	3	3	3	3	2	3	3	2	1	7	2	2	4	3	2	1	2	4	3	4	4	4	3
29	4	4	4	3	3	3	3	3	3	4	5	7	8	6	6	5	4	4	4	4	3	2	3	3	4
30	3	5	6	5	2	4	4	3	4	4	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4
OURLY EAM	3	3	3	3	3	3	3	3	4	4	4	5	4	4	5	5	5	4	4	4	3	3	3	3	

MAXIMUM= 8,0 MINIMUM= 0,4 MEAN = 3,7
720, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	6,3	5,4	5,4	4,9	4,9	5,8	6,7	5,8	5,4	7,2	8,0	6,3	5,8	6,7	7,6
MIN	0,4	3,1	1,3	1,8	0,4	0,4	1,3	1,8	1,3	2,2	0,9	0,4	0,9	4,5	3,1

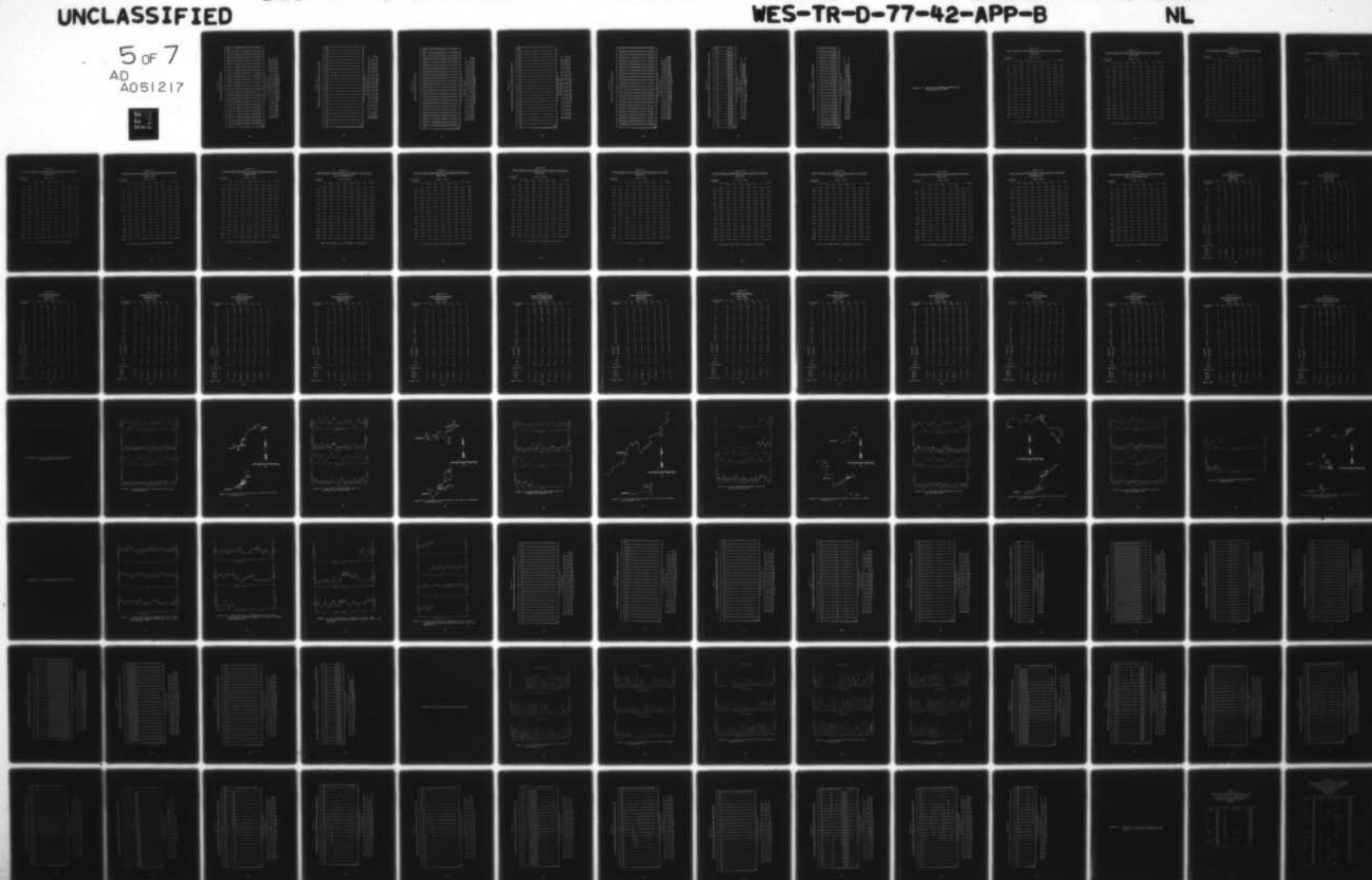
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	6,7	4,5	4,5	7,2	6,3	5,4	4,5	4,0	6,7	8,0	6,3	4,9	6,7	7,6	6,3
MIN	1,3	0,9	1,8	0,9	2,7	1,3	0,9	0,9	1,8	2,2	2,7	1,8	1,3	2,2	2,2

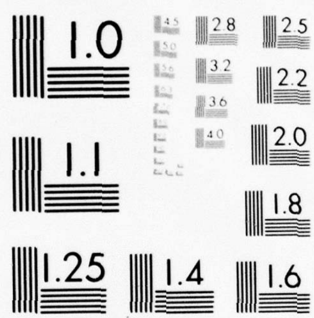
MEAN MAXIMUM= 6,0 MEAN MINIMUM= 1,6

AD-A051 217 NALCO ENVIRONMENTAL SCIENCES NORTHBROOK IL F/G 13/2
AQUATIC DISPOSAL FIELD INVESTIGATIONS ASHTABULA RIVER DISPOSAL --ETC(U)
DEC 77 L J DANEK, G R ALTHER, P P PAILY DACW39-75-C-0108

UNCLASSIFIED WES-TR-D-77-42-APP-B NL

5 OF 7
AD
A051217





MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

Table N'20

Wind Direction for June 1976

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	0	0	0	0	0	0	0	150	90	60	65	60	45	60	60	60	60	45	65	55	45	45	60	60	45
2	60	60	60	60	45	50	65	60	65	65	60	60	45	45	60	55	60	60	60	60	65	60	60	60	58
3	75	100	95	90	75	90	90	90	120	95	55	45	45	60	65	65	60	60	60	75	90	90	105	120	80
4	105	120	105	165	115	150	135	150	150	60	45	45	45	55	60	60	60	55	60	65	65	85	85	75	88
5	75	90	90	0	0	125	0	165	190	195	35	45	55	50	60	60	55	60	50	60	75	95	100	0	72
6	0	0	0	0	0	0	0	0	300	345	30	340	310	300	285	285	285	280	275	270	270	270	265	255	162
7	245	270	240	240	240	225	225	230	265	270	275	280	285	285	285	285	285	245	285	275	270	225	195	195	257
8	205	195	195	180	195	205	210	210	225	270	285	285	285	285	285	275	275	270	270	270	270	255	235	210	244
9	215	225	210	225	225	210	210	210	255	270	270	270	275	285	270	285	285	275	245	255	235	195	195	180	241
10	180	195	180	195	180	180	180	180	195	210	210	270	285	280	280	275	270	270	230	235	225	220	210	195	222
11	210	205	210	210	210	205	215	225	240	240	245	255	265	270	270	270	270	270	270	270	270	285	270	0	235
12	65	70	65	55	60	60	60	75	65	60	60	60	55	60	55	60	60	60	60	75	75	75	95	0	62
13	135	135	120	155	165	165	165	165	180	185	175	180	190	190	195	215	210	210	195	195	165	165	155	155	174
14	165	165	180	180	180	180	185	185	185	195	205	205	225	225	225	235	225	225	215	195	195	195	195	195	198
15	210	200	205	210	195	205	195	210	205	210	215	225	225	215	215	210	205	210	210	195	195	185	185	200	206
16	210	195	205	210	215	210	210	245	230	210	240	275	275	255	255	240	270	270	205	255	295	255	255	210	237
17	240	330	345	35	175	195	195	210	245	285	330	345	355	15	25	30	25	30	30	45	75	120	120	135	164
18	135	135	135	150	165	180	180	165	180	185	180	175	185	225	55	210	210	210	185	165	150	165	175	195	171
19	195	270	275	235	0	145	165	175	185	195	195	195	210	225	250	295	305	315	305	315	300	330	355	360	241
20	15	30	45	30	30	20	15	15	40	45	45	45	45	45	45	60	60	45	30	360	350	355	15	15	75
21	25	15	15	30	55	60	60	60	75	75	75	75	60	60	65	45	60	60	65	75	60	100	105	150	64
22	155	165	150	155	135	165	165	180	210	210	210	205	355	35	45	45	45	55	60	75	75	75	95	120	133
23	155	185	150	150	165	165	155	160	155	360	360	360	340	30	35	60	315	285	315	345	75	120	135	150	197
24	120	150	150	165	180	180	180	220	175	135	150	165	150	155	155	165	175	180	180	195	195	195	195	210	172
25	220	225	240	255	255	255	255	255	270	265	270	275	275	270	270	270	270	270	265	260	225	215	215	225	253
26	225	225	225	235	225	225	215	235	260	270	275	270	275	275	275	275	270	270	270	255	225	215	205	205	246
27	210	210	210	215	215	225	225	245	255	255	270	270	270	285	285	275	275	270	270	255	225	205	180	195	241
28	195	210	210	210	210	225	215	260	270	185	0	270	180	100	175	210	215	220	180	190	210	195	195	195	197
29	210	210	210	195	195	195	195	195	210	240	275	270	275	270	270	275	270	275	60	105	135	135	135	120	205
30	135	145	270	310	60	105	105	135	180	190	180	240	300	150	275	270	265	255	195	195	180	195	195	195	197
OURLY EAN	147	158	160	152	139	153	149	169	189	195	176	202	206	169	172	181	190	188	172	188	176	177	166	153	

MAXIMUM= 360,0 MINIMUM= 0,0 MEAN = 171,9

720, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	150,0	65,0	120,0	165,0	195,0	345,0	285,0	285,0	285,0	285,0	285,0	95,0	215,0	235,0	225,0
MIN	0,0	45,0	45,0	45,0	0,0	0,0	195,0	180,0	180,0	180,0	0,0	0,0	120,0	165,0	165,0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	295,0	355,0	225,0	360,0	360,0	150,0	355,0	360,0	220,0	275,0	275,0	285,0	270,0	275,0	310,0
MIN	195,0	15,0	55,0	0,0	15,0	15,0	35,0	30,0	120,0	215,0	205,0	180,0	0,0	60,0	60,0

MEAN MAXIMUM= 253,5 MEAN MINIMUM= 84,7

Table N'21

Wind Speed in meters per second for July 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	4	5	6	5	4	5	5	5	5	8	8	7	8	8	7	6	7	7	6	5	4	3	3	2	6
2	2	2	4	3	3	3	4	4	4	5	6	7	6	7	6	6	6	5	5	4	4	2	1	1	4
3	1	2	2	3	2	2	3	3	3	3	4	4	4	4	5	4	5	5	5	4	3	2	1	1	3
4	2	2	1	3	2	1	1	1	2	3	4	4	4	4	4	5	4	4	4	4	3	2	1	1	3
5	1	1	1	1	2	2	1	1	1	1	1	3	4	4	4	4	4	3	2	2	2	1	2	2	2
6	1	1	1	3	2	1	1	2	2	2	2	3	3	4	3	3	3	2	3	1	1	2	2	2	2
7	6	4	3	2	3	3	3	2	2	2	1	2	1	1	2	2	2	3	3	2	1	3	4	4	3
8	3	4	4	4	4	4	3	2	2	3	4	4	5	4	3	****	****	4	5	5	5	5	7	7	4
9	5	4	4	4	3	3	3	2	1	1	2	3	3	3	4	4	4	4	4	3	3	2	1	1	3
10	2	2	2	3	3	3	3	4	4	4	4	6	8	7	7	7	6	5	5	4	4	4	3	3	4
11	4	4	4	4	4	4	7	9	8	8	8	8	8	9	9	8	7	6	4	4	3	3	3	2	6
12	2	3	2	2	4	5	6	6	9	11	10	9	9	8	7	8	7	8	8	8	8	8	8	7	7
13	8	9	8	7	6	7	7	7	7	7	8	7	6	7	7	7	8	8	7	6	6	6	6	6	7
14	6	4	3	2	0	1	2	2	2	2	2	2	1	3	3	4	3	4	2	3	2	1	1	3	2
15	3	6	5	4	3	4	3	3	2	0	1	2	1	3	4	4	4	3	2	2	2	1	2	3	3
16	3	3	3	4	4	4	4	4	3	4	5	5	6	6	5	5	5	4	3	4	8	5	6	6	5
17	6	6	7	5	4	3	4	4	4	5	6	5	5	4	5	5	5	7	6	5	4	4	6	2	5
18	2	4	3	3	3	3	3	4	3	3	3	3	5	6	6	6	6	7	6	6	5	4	2	3	4
19	3	3	4	4	4	4	3	4	4	3	4	4	4	5	6	6	7	5	4	4	2	2	1	1	4
20	2	3	3	2	3	3	3	4	4	4	4	5	5	6	6	6	6	5	4	4	4	4	4	4	4
21	4	4	4	4	5	4	6	6	4	4	2	3	4	2	3	4	4	4	4	4	4	4	3	2	4
22	3	3	2	2	3	3	3	3	3	3	4	5	5	4	4	4	5	5	4	5	4	3	1	1	3
23	2	2	4	4	4	4	4	4	4	3	4	3	3	4	4	4	4	5	5	5	4	4	2	2	4
24	2	3	5	2	3	2	2	2	3	3	4	4	3	4	4	4	4	5	5	6	7	7	6	5	4
25	7	7	7	6	4	4	3	2	1	2	3	3	3	3	3	4	3	4	3	2	1	1	1	1	3
26	2	3	3	3	3	4	3	4	4	4	4	4	4	4	4	6	7	5	4	4	5	4	2	2	4
27	2	3	4	4	4	4	4	4	3	3	3	3	3	3	3	3	5	4	5	4	2	2	1	1	3
28	1	2	2	3	2	2	2	1	1	2	2	2	1	2	4	4	3	3	3	2	1	2	3	3	2
29	3	3	3	4	4	4	3	3	3	3	3	3	4	5	4	6	6	6	5	5	5	4	3	4	4
30	3	4	4	4	3	3	2	2	1	2	3	3	2	3	3	3	4	4	3	3	2	2	1	0	3
31	1	2	2	2	2	2	2	2	3	2	3	2	3	4	4	4	5	6	4	7	8	8	10	9	4
OURLY EAN	3	3	3	3	3	3	3	3	3	4	4	4	4	5	5	5	5	5	4	4	4	3	3	3	

MAXIMUM= 10,7 MINIMUM= 0,4 MEAN = 3,8

742, VALID OBSERVATIONS (99,7%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	8,5	7,2	5,4	4,9	4,0	3,6	6,3	6,7	4,9	8,5	8,9	10,7	8,9	6,3	5,8	
MIN	2,2	0,9	0,9	0,9	0,9	0,9	1,3	2,2	0,9	1,8	2,2	1,8	5,8	0,4	0,4	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	8,0	6,7	6,7	7,2	6,3	5,8	5,4	5,4	7,2	7,2	6,7	5,4	4,0	6,3	4,0	9,8
MIN	2,7	1,8	1,8	1,3	1,8	1,8	0,9	2,2	1,8	0,9	1,8	0,9	1,3	2,7	0,4	1,3

MEAN MAXIMUM= 6,5 MEAN MINIMUM= 1,6

Table N'22

<u>Wind Direction for July 1976</u>

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	180	195	195	195	220	215	215	225	265	270	275	270	285	285	285	275	275	275	270	270	270	240	260	215	247
2	215	210	225	220	225	215	215	215	240	250	270	270	270	270	270	270	270	270	270	265	255	215	0	0	225
3	180	180	185	195	210	210	210	210	265	315	300	300	300	300	300	300	280	290	300	285	270	285	0	0	237
4	0	25	0	5	25	80	90	110	45	15	25	30	35	45	45	45	45	45	45	45	60	90	100	135	49
5	150	165	175	180	165	155	165	155	200	190	360	355	330	315	305	300	300	280	290	285	300	0	160	155	227
6	0	0	155	165	150	0	200	165	205	220	225	315	345	345	345	345	30	35	120	0	0	150	150	150	159
7	205	205	195	195	165	225	180	180	180	185	0	345	345	125	260	210	340	205	240	210	195	300	225	225	214
8	210	210	195	205	215	210	210	205	210	240	285	285	285	330	300	****	****	285	285	285	300	330	330	330	261
9	330	345	15	55	80	60	45	80	180	185	35	30	30	15	15	15	15	25	30	45	45	45	90	125	81
10	150	150	165	180	165	180	195	195	195	180	180	195	210	200	190	195	195	210	240	210	205	195	195	190	190
11	195	195	195	215	210	240	255	255	255	255	255	260	255	255	265	255	270	265	235	210	235	270	210	220	239
12	275	330	255	275	300	330	330	330	330	340	330	320	325	330	325	320	320	330	315	315	330	330	330	330	317
13	340	350	345	330	315	375	320	325	325	330	330	330	325	315	300	315	300	300	295	300	315	300	330	325	320
14	340	345	345	300	270	300	210	195	195	185	195	210	150	95	105	155	150	150	150	45	60	60	120	165	167
15	190	220	70	125	165	195	195	195	0	0	300	330	30	300	285	300	315	315	335	30	35	60	115	135	177
16	135	150	225	240	225	225	230	225	225	240	255	265	270	285	270	270	285	270	270	270	350	350	345	345	259
17	360	360	360	360	350	330	315	315	315	315	330	330	330	315	285	285	275	275	270	270	265	240	300	240	308
18	210	210	210	210	195	210	210	210	210	220	235	240	255	260	255	270	270	270	270	265	265	240	225	195	234
19	195	195	195	200	195	195	195	195	210	210	225	250	255	270	270	275	275	270	275	270	260	255	215	180	230
20	195	195	210	195	195	195	195	195	195	205	215	210	240	225	235	225	225	210	220	210	195	195	210	210	208
21	205	210	225	225	255	240	255	240	240	240	225	240	330	60	60	65	45	45	60	60	70	90	65	65	160
22	85	90	90	75	75	75	90	100	100	105	105	100	110	135	105	90	45	60	60	55	60	60	100	120	87
23	135	150	165	165	160	180	165	165	165	190	205	185	180	240	270	255	270	270	270	270	270	270	215	180	208
24	195	215	150	135	160	180	180	330	330	340	345	345	330	330	330	345	330	325	330	335	345	330	330	330	287
25	345	360	15	15	45	45	60	150	165	150	100	40	30	30	40	30	30	30	30	40	35	80	120	150	69
26	165	155	150	150	175	180	165	180	165	180	185	185	195	215	250	270	270	270	270	270	270	270	225	180	208
27	195	210	210	210	205	210	195	210	195	220	225	225	225	225	225	300	275	285	285	285	285	270	255	180	234
28	165	155	150	150	150	165	210	0	135	150	160	185	185	350	10	45	45	45	60	60	50	90	105	120	123
29	135	160	165	180	180	205	210	195	195	195	210	195	240	255	255	255	270	270	270	275	275	305	335	315	231
30	325	315	295	300	270	270	240	215	210	50	50	50	60	45	35	15	15	15	25	345	315	315	305	240	180
31	180	185	150	195	165	185	195	180	165	175	180	195	225	260	240	255	275	300	315	330	335	330	345	350	238
OURLY EAN	198	208	184	189	190	195	198	198	204	205	213	229	225	227	217	218	210	209	216	207	210	212	204	197	

MAXIMUM= 360.0 MINIMUM= 0.0 MEAN = 206.7
742. VALID OBSERVATIONS (99.7%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	285.0	270.0	315.0	135.0	360.0	345.0	345.0	330.0	345.0	240.0	270.0	340.0	350.0	345.0	335.0
MIN	180.0	0.0	0.0	0.0	0.0	0.0	0.0	195.0	15.0	150.0	195.0	225.0	295.0	45.0	0.0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	350.0	360.0	270.0	275.0	240.0	330.0	135.0	270.0	345.0	360.0	270.0	300.0	350.0	335.0	345.0	350.0
MIN	135.0	240.0	195.0	180.0	195.0	45.0	45.0	135.0	135.0	15.0	150.0	180.0	0.0	135.0	15.0	150.0

MEAN MAXIMUM= 306.3 MEAN MINIMUM= 104.8

Table N'23

<u>Wind Speed in meters per second for August 1976</u>

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	9	9	9	9	8	7	6	7	7	7	7	7	5	5	4	4	4	4	4	5	4	4	2	2	6
2	2	4	6	5	4	2	2	3	2	2	1	4	3	3	3	4	3	4	4	4	4	6	5	5	4
3	5	4	3	2	2	2	2	2	2	2	1	1	2	3	3	4	4	4	4	3	2	2	0	2	2
4	2	2	3	3	3	2	2	3	3	3	3	3	3	3	4	4	4	3	3	2	1	1	1	2	3
5	2	3	3	3	3	3	3	3	3	4	4	4	4	6	5	6	4	4	4	3	2	4	4	2	4
6	3	3	3	4	6	6	5	6	5	5	5	4	4	4	4	4	5	5	5	4	4	5	5	5	5
7	5	5	4	4	4	4	4	5	4	4	4	5	6	6	8	8	11	10	11	11	11	11	12	12	7
8	10	9	8	7	6	5	5	4	4	5	6	6	6	4	4	4	4	4	4	4	4	4	3	2	5
9	2	2	1	2	3	2	2	2	3	2	1	****	2	2	1	2	3	2	3	2	2	2	2	3	2
10	2	2	2	3	4	4	4	3	3	2	1	2	3	3	3	3	2	3	4	3	2	0	1	2	2
11	2	3	2	3	3	3	3	3	3	3	3	3	4	4	4	4	2	1	2	3	3	2	3	3	3
12	4	4	4	4	4	4	4	4	3	3	4	4	3	3	4	6	6	5	4	4	4	4	3	3	4
13	4	3	4	6	7	4	4	3	2	2	4	3	3	3	4	5	4	5	5	4	2	2	2	3	4
14	3	3	3	2	2	2	2	3	2	2	2	3	2	1	2	3	4	2	4	2	3	2	2	2	2
15	3	3	2	2	3	4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	4
16	5	4	3	4	5	5	5	4	4	4	4	4	4	4	4	4	5	5	4	4	4	4	5	4	4
17	5	6	6	4	3	3	2	2	1	2	3	4	3	4	3	3	4	4	5	5	4	4	3	1	3
18	1	1	1	1	1	2	1	2	2	1	1	1	2	2	3	3	3	3	3	2	3	2	1	1	2
19	1	1	1	1	1	2	3	3	2	2	2	1	2	3	3	4	4	3	4	3	3	2	1	1	2
20	1	2	3	3	3	3	3	3	4	3	3	4	3	4	3	3	3	4	4	3	2	2	2	2	3
21	2	2	1	2	2	4	3	3	3	3	4	2	2	2	3	4	4	4	3	3	2	2	1	1	2
22	1	1	1	1	1	2	2	2	2	1	1	1	1	1	2	3	3	3	3	4	3	2	2	2	2
23	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	4	4	3	3	3	3	2	2	3	3
24	3	3	4	3	2	3	3	2	2	2	3	2	4	4	4	4	4	5	5	5	4	4	3	3	3
25	4	3	3	2	2	2	2	2	2	2	2	1	2	3	4	4	4	4	3	3	3	2	2	1	2
26	1	0	0	0	1	2	1	2	2	2	2	1	1	2	1	2	2	3	3	4	3	2	1	2	2
27	3	3	4	3	3	3	3	3	3	3	3	4	5	4	4	4	4	4	5	4	4	3	4	4	4
28	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	3	4	4	4	6	4	4	3	4
29	3	4	5	5	5	5	4	7	7	7	5	5	4	4	6	6	6	6	6	7	8	8	8	6	6
30	5	5	5	5	5	4	5	5	5	5	5	4	5	4	5	4	3	3	4	3	3	3	2	1	4
31	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	5	4	4	3	4	4	4
OURLY EAN	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	3	3	3	

MAXIMUM= 11,6 MINIMUM= 0,4 MEAN = 3,5
743, VALID OBSERVATIONS (99,9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	9,4	5,8	4,9	4,5	5,8	5,8	11,5	9,8	3,1	4,0	4,0	5,8	6,7	3,6	4,9	
MIN	1,8	1,3	0,4	0,9	1,8	2,7	3,6	1,8	1,3	0,4	1,3	2,7	1,8	1,3	2,2	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	5,4	6,3	3,1	3,6	3,6	4,0	3,6	3,6	5,4	4,5	3,6	4,9	5,8	8,0	5,4	4,9
MIN	3,1	1,3	0,9	0,9	1,3	0,9	0,9	1,8	1,8	1,3	0,4	2,7	2,2	3,1	1,3	2,2

MEAN MAXIMUM= 5,3 MEAN MINIMUM= 1,7

Table N'24

Wind Direction for August 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	360	360	360	360	10	15	15	15	15	15	15	30	45	15	15	345	335	330	325	330	335	330	330	315	193
2	165	10	15	15	15	120	195	180	180	195	0	360	345	335	345	330	335	345	330	325	325	330	330	335	228
3	345	350	355	240	180	165	165	165	155	165	180	0	15	345	10	15	25	30	15	25	25	45	0	150	132
4	150	150	150	150	165	165	165	180	180	180	180	195	210	300	315	315	335	330	335	345	350	30	120	150	214
5	180	150	180	195	195	195	190	195	195	195	195	210	225	225	240	240	240	210	210	215	235	265	220	210	209
6	210	210	240	360	10	15	15	20	15	30	15	30	45	55	60	60	45	45	45	60	60	65	60	65	76
7	90	90	90	90	90	90	90	90	90	90	90	60	60	60	45	30	30	15	15	15	10	10	10	10	57
8	360	5	10	5	350	355	345	345	350	355	355	355	360	330	330	330	315	315	315	315	315	300	300	255	290
9	210	210	195	205	285	195	270	330	340	330	105	****	195	210	270	320	15	10	25	30	350	10	30	20	181
10	15	345	335	345	350	360	360	360	15	30	30	300	305	330	330	305	330	315	300	305	300	0	155	140	246
11	150	150	165	165	165	165	165	180	175	175	185	185	180	210	225	255	300	300	195	195	195	195	195	195	194
12	190	195	195	195	210	210	200	210	210	180	195	210	210	210	210	225	240	250	265	255	240	225	205	195	214
13	210	210	210	235	275	240	210	225	190	210	220	210	215	240	270	275	275	285	285	285	315	270	235	180	241
14	195	190	180	180	195	180	180	160	165	160	195	180	180	180	180	10	30	30	85	150	165	165	180	180	154
15	200	215	210	195	220	300	315	305	330	330	340	355	360	15	360	350	340	330	315	315	330	335	340	340	294
16	345	360	360	360	360	350	355	350	350	355	345	345	335	330	330	315	315	305	315	295	285	300	335	345	335
17	350	360	10	15	10	10	175	155	170	180	335	340	340	340	330	325	310	300	285	280	275	270	270	270	238
18	220	300	300	195	180	180	190	190	165	180	195	350	345	15	15	30	30	30	30	30	30	30	45	90	140
19	120	125	135	135	180	155	155	150	150	150	150	180	120	30	30	30	45	45	60	65	75	75	90	115	107
20	130	150	155	165	155	165	180	180	180	180	195	190	190	195	195	135	30	30	25	25	45	75	85	105	132
21	120	120	120	135	150	150	150	160	165	165	165	180	215	360	360	360	360	25	30	45	45	45	65	105	158
22	150	150	160	180	155	155	165	165	165	155	165	225	315	15	315	315	305	285	300	285	270	270	225	210	213
23	210	210	195	180	180	180	195	185	195	195	215	245	330	330	315	300	315	315	320	315	330	15	45	75	225
24	75	90	90	90	90	90	105	100	120	90	105	65	45	45	45	60	60	60	60	60	60	70	85	90	77
25	90	100	100	95	105	100	95	100	110	120	120	120	105	30	45	45	45	45	60	60	60	60	65	130	84
26	120	0	0	0	225	210	195	195	195	195	195	195	210	250	210	180	195	205	195	205	195	210	180	195	173
27	195	210	205	210	195	185	180	180	180	180	180	205	210	210	200	210	210	205	205	205	210	195	195	195	198
28	195	195	195	205	205	205	195	195	195	195	200	195	210	195	195	150	225	195	200	225	270	265	255	240	208
29	245	255	300	315	315	320	330	350	360	360	355	340	330	315	315	315	315	330	325	330	345	345	360	360	327
30	15	15	15	360	345	340	340	340	340	335	330	335	330	315	300	315	315	315	315	315	315	285	230	180	277
31	195	180	180	180	165	165	180	180	180	180	195	195	185	185	210	195	195	210	210	205	200	195	185	195	189
HOURLY MEAN	187	183	175	186	185	185	196	198	188	189	185	213	218	201	213	216	208	195	193	197	212	170	175	182	

MAXIMUM= 360.0 MINIMUM= 0.0 MEAN = 193.7

743. VALID OBSERVATIONS (99.9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	360.0	360.0	355.0	350.0	265.0	360.0	90.0	360.0	350.0	360.0	300.0	265.0	315.0	195.0	360.0	
MIN	10.0	0.0	0.0	30.0	150.0	10.0	10.0	5.0	10.0	0.0	150.0	180.0	180.0	10.0	15.0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	360.0	360.0	350.0	180.0	195.0	360.0	315.0	330.0	120.0	130.0	250.0	210.0	270.0	360.0	360.0	210.0
MIN	285.0	10.0	15.0	30.0	25.0	25.0	15.0	15.0	45.0	30.0	0.0	180.0	150.0	245.0	15.0	165.0

MEAN MAXIMUM= 290.5 MEAN MINIMUM= 64.8

Table N'25

Wind Speed in meters per second for 1 through 14 September 1976

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	5	6	4	5	4	4	4	4	3	4	4	4	4	5	5	4	4	4	4	6	6	6	7	7	5
2	6	7	7	6	3	2	1	2	4	4	4	3	5	5	5	4	5	4	4	4	3	2	2	1	4
3	2	2	3	3	3	3	3	3	4	3	3	4	5	5	5	4	4	4	4	4	3	3	3	4	3
4	3	3	4	4	4	6	4	4	4	5	5	5	5	5	6	4	6	5	5	4	3	1	2	2	4
5	2	5	9	7	6	5	4	4	9	7	6	6	7	6	8	7	6	5	4	4	5	6	8	7	6
6	6	5	5	4	4	3	3	1	2	2	1	3	3	3	3	3	3	2	3	2	2	2	2	1	3
7	3	3	3	3	3	3	3	3	3	3	3	3	3	5	6	6	5	4	4	4	2	2	2	3	3
8	3	4	3	3	4	3	3	3	3	3	3	4	4	4	5	5	6	5	5	4	3	2	3	3	4
9	3	3	4	4	4	4	3	3	3	4	3	3	2	3	4	3	****	****	****	****	****	****	****	****	3
10	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
11	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
13	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
14	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
HOURLY MEAN	4	4	5	4	4	3	3	3	4	4	4	4	4	5	5	4	5	4	4	4	3	3	4	3	

MAXIMUM= 8,9 MINIMUM= 0,9 MEAN = 3,9
208, VALID OBSERVATIONS (61,9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MAX	6,7	6,7	5,4	5,8	8,9	6,3	5,8	5,8	3,6	*****	*****	*****	*****	*****
MIN	3,1	1,3	2,2	1,3	1,8	0,9	1,9	1,8	2,2	*****	*****	*****	*****	*****

MEAN MAXIMUM= 6,1 MEAN MINIMUM= 1,8

Table N'26

<u>Wind Direction for 1 through 14 September 1976</u>

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	190	195	200	205	195	210	205	205	205	205	210	210	235	270	265	280	275	300	345	345	360	360	15	10	229
2	15	15	30	25	90	155	165	120	55	55	45	95	45	45	45	50	45	45	45	50	60	90	90	135	67
3	135	150	150	165	150	165	180	170	165	165	180	180	195	210	210	210	210	195	195	205	200	195	185	195	182
4	195	190	210	195	200	195	195	195	195	205	210	210	240	240	265	270	275	270	270	285	280	285	270	245	233
5	255	360	15	15	15	15	360	350	345	345	340	340	340	340	360	360	360	360	355	330	340	345	345	350	290
6	350	360	15	30	30	45	75	165	180	165	180	30	25	30	45	25	350	340	330	300	270	205	190	190	164
7	185	165	165	165	165	165	165	180	180	175	180	195	240	275	275	285	275	275	285	285	285	220	210	195	216
8	195	195	180	180	195	195	195	195	195	195	210	240	255	270	270	285	280	275	275	270	240	210	190	180	224
9	180	175	165	165	165	180	195	145	180	180	195	210	225	285	295	300	****	****	****	****	****	****	****	****	204
10	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
11	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
13	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
14	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
OURLY EAN	189	201	126	127	134	147	193	197	189	188	194	190	200	218	224	229	259	258	263	259	254	239	187	188	

MAXIMUM= 360,0 MINIMUM= 10,0 MEAN = 200,8
208. VALID OBSERVATIONS (61,9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MAX	360,0	165,0	210,0	285,0	360,0	360,0	285,0	285,0	300,0	*****	*****	*****	*****	*****
MIN	10,0	15,0	135,0	190,0	15,0	15,0	165,0	180,0	165,0	*****	*****	*****	*****	*****

MEAN MAXIMUM= 290,0 MEAN MINIMUM= 98,9

APPENDIX O': WIND JOINT FREQUENCY DISTRIBUTION AND PERSISTENCE TABLES

Table O'1

Joint Frequency Distribution* of Wind Speed and Direction, June 1975

DIRECTION (FROM)	SPEED, M/SEC <.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.	TOTAL
N	0.00	4.17	0.00	0.00	0.00	0.00	0.00	4.17
NNE	0.00	0.00	2.08	0.00	0.00	0.00	0.00	2.08
NE	0.00	0.00	6.25	0.00	0.00	0.00	0.00	6.25
ENE	0.00	6.25	10.42	4.17	0.00	0.00	0.0Q	20.83
E	0.00	4.17	14.58	4.17	0.00	0.00	0.00	22.92
ESE	0.00	8.33	4.17	0.00	0.00	0.00	0.00	12.50
SE	0.00	2.08	2.08	0.00	0.00	0.00	0.00	4.17
SSE	0.00	4.17	0.00	0.00	0.00	0.00	0.00	4.17
S	0.00	4.17	2.08	0.00	0.00	0.00	0.00	6.25
SSW	0.00	10.42	0.00	0.00	0.00	0.00	0.00	10.42
SW	0.00	4.17	0.00	0.00	0.00	0.00	0.00	4.17
WSW	0.00	2.08	0.00	0.00	0.00	0.00	0.00	2.08
W	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTL	0.00	50.00	41.67	8.33	0.00	0.00	0.00	100.00

* 48 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'2

Joint Frequency Distribution* of Wind Speed and Direction,

July 1975

DIRECTION (FROM)	SPEED, M/SEC							
	<.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	0.81	0.13	0.13	0.00	0.00	0.00	1.08
NNE	0.00	0.00	2.96	1.61	0.13	0.00	0.00	4.70
NE	0.00	0.67	3.09	0.27	0.00	0.00	0.00	4.03
ENE	0.00	0.40	1.34	1.48	0.00	0.00	0.00	3.23
E	0.00	0.94	1.48	0.67	0.00	0.00	0.00	3.09
ESE	0.00	0.67	1.08	0.00	0.00	0.00	0.00	1.75
SE	0.00	2.28	1.75	0.67	0.00	0.00	0.00	4.70
SSE	0.00	1.21	11.83	0.54	0.13	0.00	0.00	13.71
S	0.00	2.42	5.65	0.40	0.00	0.00	0.00	8.47
SSW	0.00	0.94	9.41	4.17	0.13	0.00	0.00	14.65
SW	0.00	1.61	4.17	1.34	0.27	0.00	0.00	7.39
WSW	0.00	1.08	2.55	1.34	0.67	0.00	0.00	5.65
W	0.00	0.54	3.23	3.09	1.21	0.00	0.00	8.06
WNW	0.00	0.00	2.42	2.82	2.55	0.00	0.00	7.80
NW	0.00	0.67	1.34	2.15	1.21	0.00	0.00	5.38
NNW	0.00	0.54	2.96	1.34	1.48	0.00	0.00	6.32
TOTL	0.00	14.78	55.38	22.04	7.80	0.00	0.00	100.00

* 744 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'3

Joint Frequency Distribution* of Wind Speed and Direction, August 1975

DIRECTION (FROM)	SPEED, M/SEC <.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	1.48	0.00	0.00	0.00	0.00	0.00	1.48
NNE	0.00	0.27	3.77	2.16	0.54	0.00	0.00	6.74
NE	0.00	0.67	2.70	1.35	2.02	0.00	0.00	6.74
ENE	0.00	0.81	1.62	0.13	0.27	0.00	0.00	2.83
E	0.00	0.40	2.16	0.40	0.00	0.00	0.00	2.96
ESE	0.00	0.67	2.43	0.54	0.00	0.00	0.00	3.64
SE	0.00	1.75	3.64	0.00	0.00	0.00	0.00	5.39
SSE	0.00	4.31	10.11	0.54	1.62	0.00	0.00	16.58
S	0.00	1.75	4.18	0.67	0.13	0.00	0.00	6.74
SSW	0.00	3.23	11.19	2.02	0.00	0.00	0.00	16.44
SW	0.00	1.21	6.33	1.21	0.00	0.00	0.00	8.76
WSW	0.00	0.94	1.89	0.81	0.13	0.00	0.00	3.77
W	0.00	0.13	1.62	1.75	0.67	0.00	0.00	4.18
WNW	0.00	0.81	2.43	1.89	0.94	0.00	0.00	6.06
NW	0.00	0.40	1.48	0.40	0.13	0.00	0.00	2.43
NNW	0.00	0.67	3.91	0.54	0.13	0.00	0.00	5.26
TOTL	0.00	19.54	59.43	14.42	6.60	0.00	0.00	100.00

* 742 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'4

Joint Frequency Distribution* of Wind Speed and Direction, September 1975

DIRECTION (FROM)	SPEED, M/SEC <.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.	TOTAL
N	0.00	0.14	0.00	0.00	0.14	0.00	0.00	0.28
NNE	0.00	0.28	1.67	1.25	0.69	0.00	0.00	3.89
NE	0.00	0.28	1.39	0.28	0.56	0.00	0.00	2.50
ENE	0.00	0.28	0.42	0.14	0.69	0.00	0.00	1.53
E	0.00	0.56	0.83	1.94	1.94	0.00	0.00	5.28
ESE	0.00	0.14	1.39	0.28	0.00	0.00	0.00	1.81
SE	0.00	1.11	1.39	0.56	0.00	0.00	0.00	3.06
SSE	0.00	2.08	6.11	0.97	0.69	0.00	0.00	9.86
S	0.00	1.25	7.08	2.50	0.69	0.00	0.00	11.53
SSW	0.00	2.22	10.28	4.58	1.11	0.00	0.00	18.19
SW	0.00	1.39	7.64	2.64	0.00	0.00	0.00	11.67
WSW	0.00	0.69	2.36	1.11	0.42	0.00	0.00	4.58
W	0.00	0.00	0.69	1.67	1.25	0.00	0.00	3.61
WNW	0.00	0.14	0.83	2.64	2.08	0.56	0.00	6.25
NW	0.00	0.14	1.67	1.11	3.75	0.42	0.00	7.08
NNW	0.00	0.14	1.94	2.08	4.58	0.14	0.00	8.89
TOTL	0.00	10.83	45.69	23.75	18.61	1.11	0.00	100.00

* 720 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'5

Joint Frequency Distribution* of Wind Speed and Direction, October 1975

DIRECTION (FROM)	SPEED, M/SEC							
	<.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	0.83	0.00	0.14	2.78	0.14	0.00	3.89
NNE	0.00	0.56	1.67	0.42	2.23	0.14	0.00	5.01
NE	0.00	0.28	1.11	0.56	0.00	0.00	0.00	1.95
ENE	0.00	0.14	0.28	0.42	0.70	0.97	0.00	2.50
E	0.00	0.83	1.67	1.95	1.95	0.42	0.00	6.82
ESE	0.00	0.70	1.39	0.42	0.00	0.00	0.00	2.50
SE	0.00	0.97	1.25	0.00	0.00	0.00	0.00	2.23
SSE	0.00	1.25	8.07	1.39	0.70	0.00	0.00	11.40
S	0.00	0.56	4.87	2.92	1.67	0.00	0.00	10.01
SSW	0.00	1.11	9.18	9.04	0.14	0.00	0.00	19.47
SW	0.00	0.70	4.17	2.09	0.14	0.00	0.00	7.09
WSW	0.00	0.28	0.97	1.67	0.28	0.00	0.00	3.20
W	0.00	0.28	1.81	2.50	3.20	0.00	0.00	7.79
WNW	0.00	0.28	0.83	2.36	1.39	0.00	0.00	4.87
NW	0.00	0.00	0.97	2.50	1.67	0.00	0.00	5.15
NNW	0.00	0.28	1.25	1.11	3.34	0.14	0.00	6.12
TOTL	0.00	9.04	39.50	29.49	20.17	1.81	0.00	100.00

* 719 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'6

Joint Frequency Distribution* of Wind Speed and Direction, November 1975

DIRECTION (FROM)	SPEED, M/SEC <.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	0.56	0.42	0.00	0.00	0.56	1.81	3.34
NNE	0.00	0.14	0.14	0.00	0.00	0.00	0.00	0.28
NE	0.00	0.14	0.14	0.00	0.00	0.00	0.00	0.28
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	0.00	0.56	1.95	0.56	0.14	0.00	0.00	3.20
ESE	0.00	0.28	0.56	0.56	0.00	0.00	0.00	1.39
SE	0.00	0.28	0.97	0.14	0.42	0.00	0.00	1.81
SSE	0.00	0.14	2.37	0.84	0.97	0.00	0.00	4.32
S	0.00	0.70	11.42	6.82	4.74	0.84	0.00	24.51
SSW	0.00	0.70	5.85	4.87	2.79	0.14	0.00	14.35
SW	0.00	0.56	6.55	7.80	2.09	0.00	0.00	16.99
WSW	0.00	0.56	2.09	5.43	3.76	0.56	0.70	13.09
W	0.00	0.56	1.25	2.37	3.06	1.11	0.70	9.05
WNW	0.00	0.28	0.84	1.11	0.42	0.56	0.00	3.20
NW	0.00	0.28	0.56	0.14	1.67	0.56	0.00	3.20
NNW	0.00	0.00	0.14	0.00	0.00	0.84	0.00	0.97
TOTL	0.00	5.71	35.24	30.64	20.06	5.15	3.20	100.00

* 718 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'7

Joint Frequency Distribution* of Wind Speed and Direction, December 1975

DIRECTION (FROM)	SPEED, M/SEC <.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	0.83	0.00	0.00	2.50	2.08	0.00	5.42
NNE	0.00	0.42	0.00	0.00	0.83	0.00	0.00	1.25
NE	0.00	0.00	0.00	0.83	0.42	0.00	0.00	1.25
ENE	0.00	0.42	0.83	0.00	0.00	0.00	0.00	1.25
E	0.00	2.92	3.75	3.75	0.00	0.00	0.00	10.42
ESE	0.00	1.25	4.17	2.92	0.00	0.00	0.00	8.33
SE	0.00	0.00	2.92	2.08	0.00	0.00	0.00	5.00
SSE	0.00	0.00	1.67	2.50	0.00	0.00	0.00	4.17
S	0.00	0.42	2.08	10.00	5.42	0.00	0.00	17.92
SSW	0.00	0.00	0.83	1.67	0.00	0.00	0.00	2.50
SW	0.00	0.42	3.33	3.33	0.00	0.00	0.00	7.08
WSW	0.00	0.00	0.83	2.92	0.42	0.42	0.00	4.58
W	0.00	0.00	0.00	4.17	10.00	2.92	1.25	18.33
WNW	0.00	0.42	0.00	0.42	4.17	2.08	0.00	7.08
NW	0.00	0.00	0.42	0.83	4.17	0.00	0.00	5.42
NNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTL	0.00	7.08	20.83	35.42	27.92	7.50	1.25	100.00

* 240 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'8

Joint Frequency Distribution* of Wind Speed and Direction, July to December 1975

DIRECTION (FROM)	SPEED, M/SEC							
	<.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	0.77	0.10	0.05	0.70	0.26	0.33	2.21
NNE	0.00	0.26	1.93	1.03	0.72	0.03	0.00	3.97
NE	0.00	0.39	1.60	0.52	0.52	0.00	0.00	3.01
ENE	0.00	0.33	0.75	0.41	0.31	0.18	0.00	1.98
E	0.00	0.80	1.75	1.26	0.75	0.08	0.00	4.64
ESE	0.00	0.54	1.55	0.52	0.00	0.00	0.00	2.60
SE	0.00	1.21	1.88	0.39	0.08	0.00	0.00	3.55
SSE	0.00	1.70	7.37	0.95	0.77	0.00	0.00	10.79
S	0.00	1.29	6.34	3.09	1.67	0.15	0.00	12.54
SSW	0.00	1.55	8.68	4.71	0.77	0.03	0.00	15.74
SW	0.00	1.06	5.61	3.01	0.46	0.00	0.00	10.15
WSW	0.00	0.67	1.91	2.11	1.00	0.13	0.13	5.95
W	0.00	0.28	1.62	2.40	2.37	0.39	0.21	7.26
WNW	0.00	0.31	1.39	2.06	1.65	0.33	0.00	5.74
NW	0.00	0.28	1.16	1.24	1.83	0.18	0.00	4.69
NNW	0.00	0.31	1.93	0.95	1.78	0.21	0.00	5.18
TOTL	0.00	11.74	45.56	24.70	15.37	1.96	0.67	100.00

*3883 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'9

Joint Frequency Distribution* of Wind Speed and Direction, March 1976

DIRECTION (FROM)	SPEED, M/SEC <.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	2.81	0.00	0.00	0.00	0.00	2.81
NE	0.00	0.00	1.12	0.00	0.00	0.00	0.00	1.12
ENE	0.00	0.56	1.12	0.00	0.00	0.00	0.00	1.69
E	0.00	1.69	1.69	0.56	0.00	0.00	0.00	3.93
ESE	0.00	1.12	2.25	0.00	0.00	0.00	0.00	3.37
SE	0.00	0.00	0.56	1.69	0.00	0.00	0.00	2.25
SSE	0.00	0.56	3.37	6.74	3.93	0.00	0.00	14.61
S	0.00	0.56	3.37	3.37	2.81	0.00	0.00	10.11
SSW	0.00	0.00	1.69	3.37	10.67	0.00	0.00	15.73
SW	0.00	0.00	2.25	1.69	5.06	0.56	0.00	9.55
WSW	0.00	0.00	1.69	2.25	0.56	0.00	0.00	4.49
W	0.00	0.56	0.56	1.69	9.55	1.12	2.25	15.73
WNW	0.00	0.56	0.56	1.12	1.69	1.69	0.00	5.62
NW	0.00	1.12	1.69	0.00	1.69	0.00	0.00	4.49
NNW	0.00	0.56	1.69	1.69	0.56	0.00	0.00	4.49
TOTL	0.00	7.30	26.40	24.16	36.52	3.37	2.25	100.00

* 178 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'10

Joint Frequency Distribution* of Wind Speed and Direction, April 1976

DIRECTION (FROM)	SPEED, M/SEC <.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	1.67	0.56	0.70	0.56	1.39	0.28	5.15
NNE	0.00	0.83	1.53	0.83	0.83	0.70	0.28	5.01
NE	0.00	0.70	2.09	1.39	0.83	0.00	0.00	5.01
ENE	0.00	0.70	2.09	2.23	4.31	0.42	0.00	9.74
E	0.00	0.56	1.39	0.97	0.70	0.00	0.00	3.62
ESE	0.00	0.42	0.42	0.00	0.00	0.00	0.00	0.83
SE	0.00	0.14	0.42	0.42	0.00	0.00	0.00	0.97
SSE	0.00	0.70	2.36	0.28	0.00	0.00	0.00	3.34
S	0.00	0.56	4.31	0.14	0.00	0.00	0.00	5.01
SSW	0.00	0.83	6.95	2.23	0.14	0.00	0.00	10.15
SW	0.00	0.56	5.98	0.83	0.28	0.00	0.00	7.65
WSW	0.00	0.42	2.36	1.39	0.56	0.00	0.00	4.73
W	0.00	0.28	1.11	4.45	6.54	0.28	0.00	12.66
WNW	0.00	0.14	1.81	4.87	4.31	0.00	0.00	11.13
NW	0.00	0.42	1.25	0.83	3.06	0.42	0.00	5.98
NNW	0.00	0.14	1.81	1.81	3.34	1.95	0.00	9.04
TOTL	0.00	9.04	36.44	23.37	25.45	5.15	0.56	100.00

* 719 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'11

Joint Frequency Distribution* of Wind Speed and Direction, May 1976

DIRECTION (FROM)	SPEED, M/SEC							
	<.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	1.34	0.40	0.67	0.40	0.81	0.13	3.76
NNE	0.00	0.27	1.48	0.94	0.94	0.27	0.00	3.90
NE	0.00	0.13	2.96	2.28	0.13	0.00	0.00	5.51
ENE	0.00	0.40	1.75	2.28	0.54	0.00	0.00	4.97
E	0.00	0.67	0.81	0.40	0.54	0.00	0.00	2.42
ESE	0.00	0.94	0.67	0.00	0.00	0.00	0.00	1.61
SE	0.00	0.54	2.96	0.54	0.00	0.00	0.00	4.03
SSE	0.00	1.21	5.51	3.76	0.81	0.00	0.00	11.29
S	0.00	0.67	2.15	1.34	0.00	0.00	0.00	4.17
SSW	0.00	0.94	4.70	3.90	0.94	0.13	0.00	10.62
SW	0.00	0.40	2.02	1.34	1.48	1.08	0.00	6.32
WSW	0.00	0.40	1.21	0.67	1.08	0.27	0.00	3.63
W	0.00	0.13	1.75	2.96	4.44	0.13	0.13	9.54
WNW	0.00	0.27	1.61	3.09	3.90	1.08	0.13	10.08
NW	0.00	0.00	1.88	2.82	2.96	0.67	0.00	8.33
NNW	0.00	0.27	2.82	2.42	4.17	0.13	0.00	9.81
TOTL	0.00	8.60	34.68	29.44	22.31	4.57	0.40	100.00

* 744 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'12

Joint Frequency Distribution* of Wind Speed and Direction, June 1976

DIRECTION (FROM)	SPEED, M/SEC <.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.	TOTAL
N	0.00	3.47	0.69	0.42	0.00	0.00	0.00	4.58
NNE	0.00	0.28	1.11	1.39	0.28	0.00	0.00	3.06
NE	0.00	0.28	2.22	3.75	0.28	0.00	0.00	6.53
ENE	0.00	0.69	5.56	6.25	0.97	0.00	0.00	13.47
E	0.00	0.97	1.11	0.69	0.00	0.00	0.00	2.78
ESE	0.00	1.11	1.25	0.14	0.00	0.00	0.00	2.50
SE	0.00	0.56	1.81	0.14	0.00	0.00	0.00	2.50
SSE	0.00	1.94	3.75	0.97	0.28	0.00	0.00	6.94
S	0.00	0.42	4.03	2.64	0.56	0.00	0.00	7.64
SSW	0.00	0.83	9.17	4.58	2.22	0.00	0.00	16.81
SW	0.00	0.97	5.14	1.11	1.25	0.00	0.00	8.47
WSW	0.00	0.28	2.64	0.97	1.39	0.00	0.00	5.28
W	0.00	0.42	2.36	5.28	4.86	0.00	0.00	12.92
WNW	0.00	0.28	0.97	2.64	0.28	0.00	0.00	4.17
NW	0.00	0.14	0.56	0.42	0.00	0.00	0.00	1.11
NNW	0.00	0.14	0.83	0.28	0.00	0.00	0.00	1.25
TOTL	0.00	12.78	43.19	31.67	12.36	0.00	0.00	100.00

* 720 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'13

Joint Frequency Distribution* of Wind Speed and Direction, July 1976

DIRECTION (FROM)	SPEED, M/SEC							
	<.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	2.43	0.54	0.27	0.67	0.27	0.00	4.18
NNE	0.00	0.27	2.70	0.67	0.27	0.00	0.00	3.91
NE	0.00	0.81	2.56	1.62	0.00	0.00	0.00	4.99
ENE	0.00	0.40	2.29	0.54	0.00	0.00	0.00	3.23
E	0.00	0.81	1.89	0.27	0.00	0.00	0.00	2.96
ESE	0.00	0.54	1.08	0.13	0.00	0.00	0.00	1.75
SE	0.00	0.67	0.54	0.27	0.00	0.00	0.00	1.48
SSE	0.00	3.10	4.45	0.40	0.00	0.00	0.00	7.95
S	0.00	1.89	3.64	0.81	0.13	0.00	0.00	6.47
SSW	0.00	2.16	9.03	3.77	0.94	0.00	0.00	15.90
SW	0.00	0.54	4.72	1.75	0.67	0.00	0.00	7.68
WSW	0.00	0.67	1.35	2.83	1.35	0.27	0.00	6.47
W	0.00	0.40	1.75	4.85	4.45	0.13	0.00	11.59
WNW	0.00	0.67	2.02	2.83	1.62	0.00	0.00	7.14
NW	0.00	0.27	1.35	1.08	2.02	0.27	0.00	4.99
NNW	0.00	0.54	2.29	2.02	3.91	0.40	0.13	9.30
TOTL	0.00	16.17	42.18	24.12	16.04	1.35	0.13	100.00

* 742 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'14

Joint Frequency Distribution* of Wind Speed and Direction, August 1976

DIRECTION (FROM)	SPEED, M/SEC							
	<.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	1.53	1.95	3.20	2.09	0.83	0.56	10.15
NNE	0.00	0.70	4.73	2.09	1.53	0.14	0.42	9.60
NE	0.00	0.56	1.11	1.39	0.14	0.00	0.00	3.20
ENE	0.00	0.56	1.53	1.95	0.28	0.00	0.00	4.31
E	0.00	0.56	2.36	1.39	0.00	0.00	0.00	4.31
ESE	0.00	2.23	0.70	0.00	0.00	0.00	0.00	2.92
SE	0.00	0.97	0.14	0.00	0.00	0.00	0.00	1.11
SSE	0.00	3.34	5.15	0.00	0.00	0.00	0.00	8.48
S	0.00	2.92	5.70	0.28	0.00	0.00	0.00	8.90
SSW	0.00	2.64	8.48	5.56	0.00	0.00	0.00	16.69
SW	0.00	0.83	1.81	0.28	0.42	0.00	0.00	3.34
WSW	0.00	0.28	1.25	0.83	0.28	0.00	0.00	2.64
W	0.00	0.56	0.56	1.11	0.28	0.00	0.00	2.50
WNW	0.00	0.70	1.53	1.53	0.00	0.00	0.00	3.76
NW	0.00	0.28	3.62	2.64	0.56	0.00	0.00	7.09
NNW	0.00	0.42	4.03	5.84	0.70	0.00	0.00	10.99
TOTL	0.00	19.05	44.65	28.09	6.26	0.97	0.97	100.00

* 719 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'15

Joint Frequency Distribution* of Wind Speed and Direction, September 1976

DIRECTION (FROM)	SPEED, M/SEC <.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.	TOTAL
N	0.00	0.00	0.48	2.88	3.85	0.00	0.00	7.21
NNE	0.00	0.00	1.92	1.92	3.37	0.48	0.00	7.69
NE	0.00	0.00	1.44	4.81	0.00	0.00	0.00	6.25
ENE	0.00	0.00	0.96	0.00	0.00	0.00	0.00	0.96
E	0.00	0.96	0.96	0.00	0.00	0.00	0.00	1.92
ESE	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.48
SE	0.00	0.48	0.48	0.00	0.00	0.00	0.00	0.96
SSE	0.00	1.92	7.69	0.00	0.00	0.00	0.00	9.62
S	0.00	1.92	10.10	0.48	0.00	0.00	0.00	12.50
SSW	0.00	0.96	12.98	9.62	0.48	0.00	0.00	24.04
SW	0.00	0.48	0.96	0.00	0.00	0.00	0.00	1.44
WSW	0.00	0.96	0.96	1.92	0.00	0.00	0.00	3.85
W	0.00	0.96	1.44	5.77	2.40	0.00	0.00	10.58
WNW	0.00	0.48	3.37	1.44	0.48	0.00	0.00	5.77
NW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.96	1.44	4.33	0.00	0.00	6.73
TOTL	0.00	9.13	45.19	30.29	14.90	0.48	0.00	100.00

* 208 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'16

Joint Frequency Distribution* of Wind Speed and Direction, March to September 1976

DIRECTION (FROM)	SPEED, M/SEC <.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.	TOTAL
N	0.00	1.87	0.76	1.09	0.86	0.59	0.17	5.35
NNE	0.00	0.42	2.29	1.16	0.86	0.22	0.12	5.08
NE	0.00	0.44	2.10	2.12	0.25	0.00	0.00	4.91
ENE	0.00	0.52	2.47	2.37	1.09	0.07	0.00	6.51
E	0.00	0.76	1.48	0.69	0.22	0.00	0.00	3.16
ESE	0.00	0.99	0.86	0.05	0.00	0.00	0.00	1.90
SE	0.00	0.54	1.11	0.32	0.00	0.00	0.00	1.97
SSE	0.00	1.97	4.42	1.28	0.37	0.00	0.00	8.04
S	0.00	1.28	4.39	1.18	0.25	0.00	0.00	7.10
SSW	0.00	1.38	7.70	4.46	1.26	0.02	0.00	14.82
SW	0.00	0.62	3.68	1.04	0.96	0.22	0.00	6.51
WSW	0.00	0.42	1.70	1.41	0.86	0.10	0.00	4.49
W	0.00	0.39	1.46	3.72	4.24	0.15	0.12	10.09
WNW	0.00	0.42	1.63	2.81	1.92	0.27	0.02	7.08
NW	0.00	0.25	1.63	1.41	1.63	0.25	0.00	5.16
NNW	0.00	0.30	2.24	2.37	2.44	0.44	0.02	7.82
TOTL	0.00	12.58	39.91	27.48	17.22	2.34	0.47	100.00

*4054 TOTAL HOURS USED IN FREQUENCY DISTRIBUTION

Table O'17

Wind Speed Persistence,

June 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.
1	0	0	2	2	0	0	0
2	0	2	0	1	0	0	0
3	0	0	2	0	0	0	0
4	0	0	1	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0
9	0	0	0	0	0	0	0
10	0	2	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	10	8	2	0	0	0
TOTAL	0	4	6	3	0	0	0
PERCENTILES							
50 %	0	2	3	1	0	0	0
80 %	0	10	4	2	0	0	0
90 %	0	10	8	2	0	0	0
95 %	0	10	8	2	0	0	0
99 %	0	10	8	2	0	0	0
SAMPLE SIZE	0	24	20	4	0	0	0

Table O'18

Wind Speed Persistence,

July 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.
1	0	24	19	26	10	0	0
2	0	5	16	12	3	0	0
3	0	6	11	12	2	0	0
4	0	5	10	5	3	0	0
5	0	0	4	3	2	0	0
6	0	2	3	3	0	0	0
7	0	1	4	1	2	0	0
8	0	1	1	1	0	0	0
9	0	0	0	0	0	0	0
10	0	0	2	1	0	0	0
11	0	1	2	0	0	0	0
12	0	0	4	0	0	0	0
13	0	0	2	0	0	0	0
14	0	0	2	0	0	0	0
15	0	0	1	0	0	0	0
16	0	0	1	0	0	0	0
17	0	0	1	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	1	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	11	22	10	7	0	0
TOTAL	0	45	84	64	22	0	0
PERCENTILES							
50 %	0	1	3	2	2	0	0
80 %	0	4	8	4	4	0	0
90 %	0	6	12	5	5	0	0
95 %	0	7	14	6	7	0	0
99 %	0	11	22	10	7	0	0
SAMPLE SIZE	0	110	412	164	58	0	0

Table O'19

Wind Speed Persistence,

August 1975

PERSISTENCE (HOURS)	<.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.
			SPEED, M/SEC				
1	0	18	18	31	6	0	0
2	0	6	13	14	1	0	0
3	0	8	14	3	2	0	0
4	0	8	8	5	1	0	0
5	0	1	7	1	1	0	0
6	0	3	5	1	0	0	0
7	0	0	4	0	0	0	0
8	0	2	4	1	1	0	0
9	0	1	2	0	2	0	0
10	0	0	4	0	0	0	0
11	0	1	5	0	0	0	0
12	0	0	1	0	0	0	0
13	0	0	1	0	0	0	0
14	0	0	1	0	0	0	0
15	0	0	2	0	0	0	0
16	0	0	1	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	11	16	8	9	0	0
TOTAL	0	48	90	56	14	0	0
PERCENTILES							
50 %	0	2	3	1	2	0	0
80 %	0	4	8	2	8	0	0
90 %	0	6	11	4	9	0	0
95 %	0	8	13	5	9	0	0
99 %	0	11	16	8	9	0	0
SAMPLE SIZE	0	145	441	107	49	0	0

Table O'20

Wind Speed Persistence,

September 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.
1	0	19	27	24	8	1	0
2	0	9	10	13	4	0	0
3	0	7	11	9	2	1	0
4	0	1	8	5	0	1	0
5	0	0	6	6	1	0	0
6	0	1	3	0	0	0	0
7	0	0	2	0	1	0	0
8	0	0	2	3	3	0	0
9	0	0	2	1	0	0	0
10	0	1	1	0	1	0	0
11	0	0	2	1	1	0	0
12	0	0	1	0	0	0	0
13	0	0	1	0	0	0	0
14	0	0	1	0	0	0	0
15	0	0	2	0	0	0	0
16	0	0	0	0	1	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	1	0	0
20	0	0	1	0	1	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	10	20	11	20	4	0
TOTAL	0	38	80	62	24	3	0
PERCENTILES							
50 %	0	1	3	2	2	3	0
80 %	0	3	6	4	10	4	0
90 %	0	3	10	5	16	4	0
95 %	0	6	13	8	19	4	0
99 %	0	10	20	11	20	4	0
SAMPLE SIZE	0	78	329	171	134	8	0

Table O'21

Wind Speed Persistence,

October 1975

PERSISTENCE (HOURS)	<.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.
	SPEED, M/SEC						
1	0	13	23	23	7	3	0
2	0	8	13	11	1	0	0
3	0	5	11	9	3	0	0
4	0	4	9	4	0	0	0
5	0	1	6	6	2	0	0
6	0	0	3	2	4	0	0
7	0	0	0	0	3	0	0
8	0	0	5	1	0	0	0
9	0	0	0	1	0	0	0
10	0	0	0	1	1	1	0
11	0	0	0	1	2	0	0
12	0	0	3	1	0	0	0
13	0	0	1	0	0	0	0
14	0	0	1	1	0	0	0
15	0	0	1	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	1	1	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	1	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	5	15	18	22	10	0
TOTAL	0	31	76	62	25	4	0
PERCENTILES							
50 %	0	2	3	2	5	1	0
80 %	0	3	5	5	7	10	0
90 %	0	4	8	8	11	10	0
95 %	0	4	12	11	18	10	0
99 %	0	5	15	18	22	10	0
SAMPLE SIZE	0	65	284	212	145	13	0

Table O'22

Wind Speed Persistence,

November 1975

PERSISTENCE (HOURS)	<.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.
			SPEED, M/SEC				
1	0	6	13	21	16	6	2
2	0	2	10	20	7	4	0
3	0	4	9	4	3	1	0
4	0	2	5	7	4	2	1
5	0	1	3	3	2	1	1
6	0	1	1	0	5	0	0
7	0	0	2	2	1	1	0
8	0	0	2	1	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	1	0	0	0
11	0	0	0	1	1	0	0
12	0	0	3	1	0	0	1
13	0	0	0	1	0	0	0
14	0	0	1	1	0	0	0
15	0	0	1	0	1	0	0
16	0	0	0	0	1	0	0
17	0	0	0	0	0	0	0
18	0	0	1	0	0	0	0
19	0	0	1	0	0	0	0
20	0	0	1	0	0	0	0
21 - 25	0	0	0	1	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	6	20	22	16	7	12
TOTAL	0	16	53	64	41	15	5
PERCENTILES							
50 %	0	2	3	2	2	2	4
80 %	0	4	7	4	6	4	5
90 %	0	5	12	8	6	5	12
95 %	0	6	18	12	11	7	12
99 %	0	6	20	22	16	7	12
SAMPLE SIZE	0	41	253	220	144	37	23

Table O'23

Wind Speed Persistence,

December 1975

PERSISTENCE (HOURS)	SPEED, M/SEC <.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.
1	0	2	3	6	7	3	1
2	0	2	2	2	3	4	1
3	0	1	2	0	3	1	0
4	0	0	1	1	2	1	0
5	0	0	1	0	0	0	0
6	0	0	1	2	1	0	0
7	0	0	2	3	0	0	0
8	0	1	1	2	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	1	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	1	1	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	1	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	8	8	12	19	4	2
TOTAL	0	6	13	18	18	9	2
PERCENTILES							
50 %	0	2	3	4	2	2	1
80 %	0	3	7	8	4	3	2
90 %	0	8	7	10	12	4	2
95 %	0	8	8	12	19	4	2
99 %	0	8	8	12	19	4	2
SAMPLE SIZE	0	17	50	85	67	18	3

Table O'24

Wind Speed Persistence,

July to December 1975

PERSISTENCE (HOURS)	<.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.
			SPEED, M/SEC				
1	0	81	101	131	53	13	3
2	0	32	65	72	19	8	1
3	0	30	58	37	14	3	0
4	0	21	41	27	10	4	1
5	0	3	27	19	8	1	1
6	0	7	16	8	10	0	0
7	0	1	14	6	7	1	0
8	0	4	15	9	4	0	0
9	0	1	4	2	1	0	0
10	0	1	7	4	3	1	0
11	0	2	9	3	4	0	0
12	0	0	12	3	1	0	1
13	0	0	5	1	0	0	0
14	0	0	6	2	0	0	0
15	0	0	7	0	0	0	0
16	0	0	2	0	2	0	0
17	0	0	1	0	0	0	0
18	0	0	1	1	2	0	0
19	0	0	1	0	2	0	0
20	0	0	2	0	1	0	0
21 - 25	0	0	1	1	1	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	11	22	22	22	10	12
TOTAL	0	183	395	326	142	31	7
PERCENTILES							
50 %	0	2	3	2	2	2	2
80 %	0	4	7	4	6	4	5
90 %	0	5	11	6	10	4	12
95 %	0	6	14	9	16	7	12
99 %	0	11	19	14	20	10	12
SAMPLE SIZE	0	456	1769	959	597	76	26

Table O'25

Wind Speed Persistence,

March 1976

PERSISTENCE (HOURS)	<.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.
			SPEED, M/SEC				
1	0	7	7	9	2	1	0
2	0	0	9	2	4	1	0
3	0	0	0	4	1	1	0
4	0	0	1	1	1	0	1
5	0	0	0	0	0	0	0
6	0	1	0	1	1	0	0
7	0	0	0	0	0	0	0
8	0	0	1	1	1	0	0
9	0	0	0	0	0	0	0
10	0	0	1	0	1	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	1	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	6	10	8	24	3	4
TOTAL	0	8	19	18	12	3	1
PERCENTILES							
50 %	0	1	2	1	2	2	4
80 %	0	1	2	3	8	3	4
90 %	0	6	8	6	10	3	4
95 %	0	6	10	8	24	3	4
99 %	0	6	10	8	24	3	4
SAMPLE SIZE	0	13	47	43	65	6	4

Table O'26

Wind Speed Persistence,

April 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.
1	0	7	30	42	12	5	2
2	0	5	9	16	8	3	1
3	0	4	8	8	6	1	0
4	0	5	4	4	4	1	0
5	0	2	3	3	5	0	0
6	0	1	2	3	3	0	0
7	0	0	6	3	0	0	0
8	0	0	2	0	4	1	0
9	0	0	0	0	0	0	0
10	0	0	1	0	0	0	0
11	0	0	2	0	0	1	0
12	0	0	1	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	2	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	1	0	0
17	0	0	1	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	1	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	6	17	7	30	11	2
TOTAL	0	24	71	79	44	12	3
PERCENTILES							
50 %	0	2	2	1	3	2	1
80 %	0	4	7	3	6	4	2
90 %	0	5	8	5	8	8	2
95 %	0	5	12	6	8	11	2
99 %	0	6	17	7	30	11	2
SAMPLE SIZE	0	65	262	168	183	37	4

Table O'27

Wind Speed Persistence,

May 1976

PERSISTENCE (HOURS)	<.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.
			SPEED, M/SEC				
1	0	16	33	32	13	6	3
2	0	7	17	20	9	4	0
3	0	3	12	9	5	1	0
4	0	3	6	10	3	0	0
5	0	1	3	5	4	1	0
6	0	0	5	2	1	2	0
7	0	0	3	5	1	0	0
8	0	1	1	1	2	0	0
9	0	0	3	0	1	0	0
10	0	0	3	0	3	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	1	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	8	10	8	20	6	1
TOTAL	0	31	86	84	43	14	3
PERCENTILES							
50 %	0	1	2	2	2	2	1
80 %	0	3	5	4	6	5	1
90 %	0	4	7	5	9	6	1
95 %	0	5	9	7	10	6	1
99 %	0	8	10	8	20	6	1
SAMPLE SIZE	0	64	258	219	166	34	3

Table O'28

Wind Speed Persistence,

June 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.45	.45– 1.8	1.8– 3.6	3.6– 5.8	5.8– 8.5	8.5– 11.	>11.
1	0	17	28	30	13	0	0
2	0	5	14	11	2	0	0
3	0	2	11	11	6	0	0
4	0	2	6	4	2	0	0
5	0	2	4	6	0	0	0
6	0	0	5	4	0	0	0
7	0	2	3	0	0	0	0
8	0	1	3	0	0	0	0
9	0	1	1	3	0	0	0
10	0	1	1	1	0	0	0
11	0	0	3	1	0	0	0
12	0	0	2	1	1	0	0
13	0	0	1	1	0	0	0
14	0	0	1	0	1	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	1	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	10	14	13	20	0	0
TOTAL	0	33	83	73	26	0	0
PERCENTILES							
50 %	0	1	2	2	1	0	0
80 %	0	5	6	5	3	0	0
90 %	0	7	9	6	12	0	0
95 %	0	9	11	10	14	0	0
99 %	0	10	14	13	20	0	0
SAMPLE SIZE	0	92	311	228	89	0	0

Table O'29

Wind Speed Persistence,

July 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.
1	0	14	20	30	8	3	1
2	0	9	21	13	6	2	0
3	0	9	11	8	4	1	0
4	0	5	16	9	3	0	0
5	0	3	5	2	2	0	0
6	0	1	4	2	1	0	0
7	0	1	6	1	2	0	0
8	0	0	4	2	0	0	0
9	0	0	2	2	0	0	0
10	0	0	0	0	1	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	1	0	0
13	0	1	1	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	1	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	13	13	9	23	3	1
TOTAL	0	43	90	69	29	6	1
PERCENTILES							
50 %	0	2	3	2	3	1	1
80 %	0	4	5	4	6	2	1
90 %	0	5	7	6	10	3	1
95 %	0	6	8	8	12	3	1
99 %	0	13	13	9	23	3	1
SAMPLE SIZE	0	120	313	179	119	10	1

Table O'30

Wind Speed Persistence,

August 1976

PERSISTENCE (HOURS)	<.45	.45- 1.8	1.8- 3.6	3.6- 5.8	5.8- 8.5	8.5- 11.	>11.
	SPEED, M/SEC						
1	0	15	27	20	6	1	1
2	0	12	13	9	4	1	0
3	0	5	6	4	3	0	0
4	0	5	6	4	1	1	0
5	0	2	3	3	0	0	0
6	0	1	2	4	0	0	1
7	0	0	4	0	0	0	0
8	0	3	8	2	1	0	0
9	0	0	2	1	0	0	0
10	0	1	1	0	1	0	0
11	0	0	0	0	0	0	0
12	0	0	2	0	0	0	0
13	0	1	1	1	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	1	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	1	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	1	2	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	13	23	22	10	4	6
TOTAL	0	45	77	51	16	3	2
PERCENTILES							
50 %	0	2	2	2	2	2	1
80 %	0	4	8	6	3	4	6
90 %	0	8	9	8	8	4	6
95 %	0	8	12	16	10	4	6
99 %	0	13	23	22	10	4	6
SAMPLE SIZE	0	137	321	202	45	7	7

Table O'31

Wind Speed Persistence,

September 1976

PERSISTENCE (HOURS)	<.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.
	SPEED, M/SEC						
1	0	2	7	8	5	1	0
2	0	1	3	0	2	0	0
3	0	1	1	6	0	0	0
4	0	3	0	2	1	0	0
5	0	0	0	1	0	0	0
6	0	0	1	1	0	0	0
7	0	0	1	1	0	0	0
8	0	0	0	0	0	0	0
9	0	0	1	0	2	0	0
10	0	0	0	0	0	0	0
11	0	0	0	1	0	0	0
12	0	0	1	0	0	0	0
13	0	0	2	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	1	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	4	18	11	9	1	0
TOTAL	0	7	18	20	10	1	0
PERCENTILES							
50 %	0	3	2	3	1	1	0
80 %	0	4	12	4	4	1	0
90 %	0	4	13	6	9	1	0
95 %	0	4	18	7	9	1	0
99 %	0	4	18	11	9	1	0
SAMPLE SIZE	0	19	94	63	31	1	0

Table O'32

Wind Speed Persistence,

January to September 1976

PERSISTENCE (HOURS)	SPEED, M/SEC <.45	.45-1.8	1.8-3.6	3.6-5.8	5.8-8.5	8.5-11.	>11.
1	0	78	152	170	59	17	7
2	0	39	85	69	35	10	1
3	0	24	49	51	25	4	0
4	0	22	39	35	15	1	1
5	0	10	18	20	11	1	0
6	0	4	19	17	6	3	1
7	0	3	22	10	3	0	0
8	0	5	19	6	8	1	0
9	0	0	10	6	3	0	0
10	0	2	6	2	6	0	0
11	0	0	7	2	0	1	0
12	0	0	6	1	2	0	0
13	0	3	5	2	0	0	0
14	0	0	3	0	1	0	0
15	0	0	0	0	0	0	0
16	0	0	0	1	1	0	0
17	0	0	1	0	0	0	0
18	0	0	1	0	0	0	0
19	0	0	1	0	0	0	0
20	0	0	0	0	2	0	0
21 - 25	0	0	1	2	2	0	0
26 - 30	0	0	0	0	1	0	0
31 - 35	0	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0	0
> 50	0	0	0	0	0	0	0
MAX	0	13	23	22	30	11	6
TOTAL	0	190	444	394	180	38	10
PERCENTILES							
50 %	0	2	2	2	2	2	1
80 %	0	4	6	4	5	3	2
90 %	0	5	8	6	8	6	4
95 %	0	8	11	8	10	8	6
99 %	0	13	14	13	24	11	6
SAMPLE SIZE	0	510	1618	1114	698	95	19

APPENDIX P': SPEED-DIRECTION AND PROGRESSIVE VECTOR PLOTS OF THE WIND

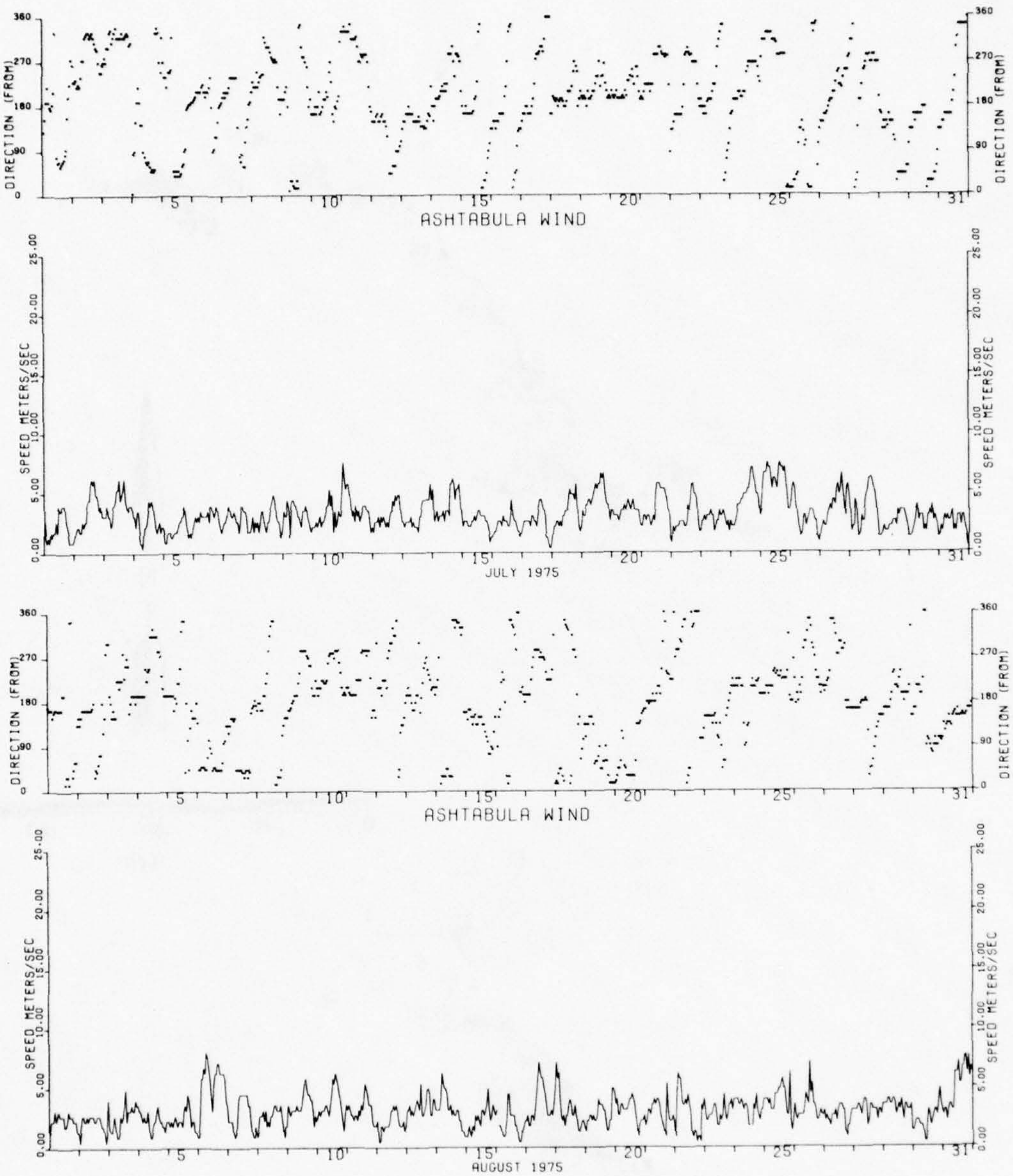


Figure P'1. Wind speed and direction plots for July and August 1975

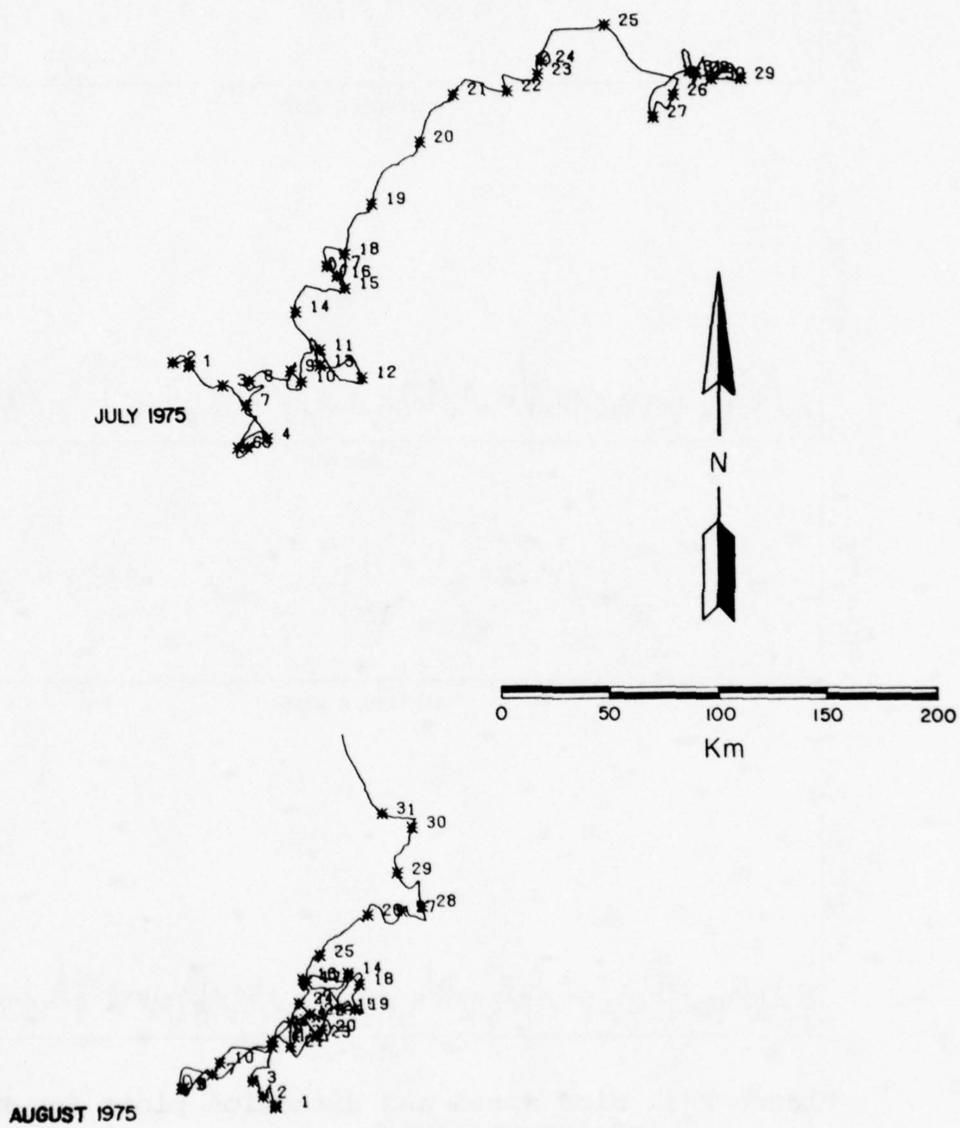


Figure P'2. Progressive vector plots of the wind for July and August 1975

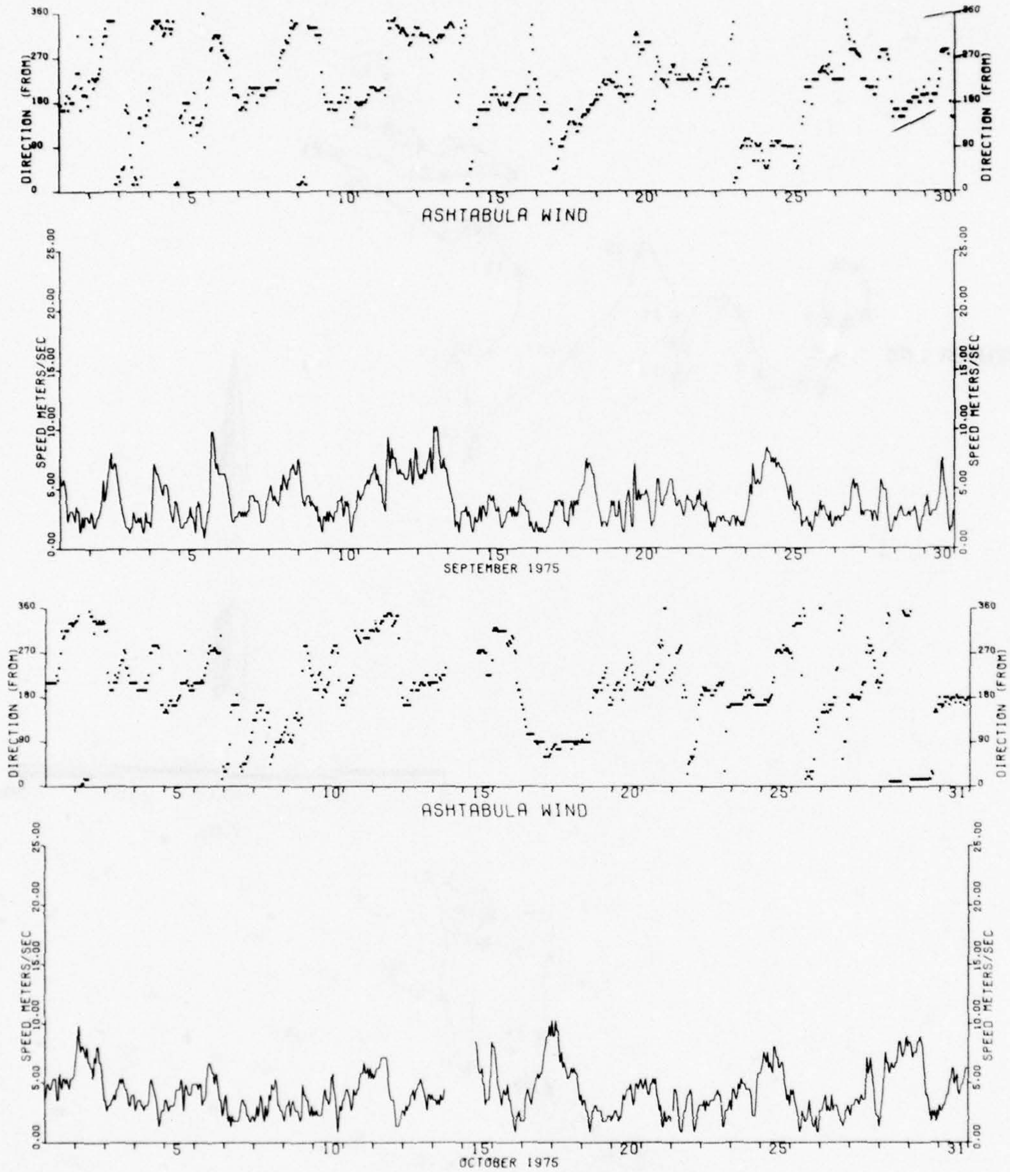


Figure P'3. Wind speed and direction plots for September and October 1975

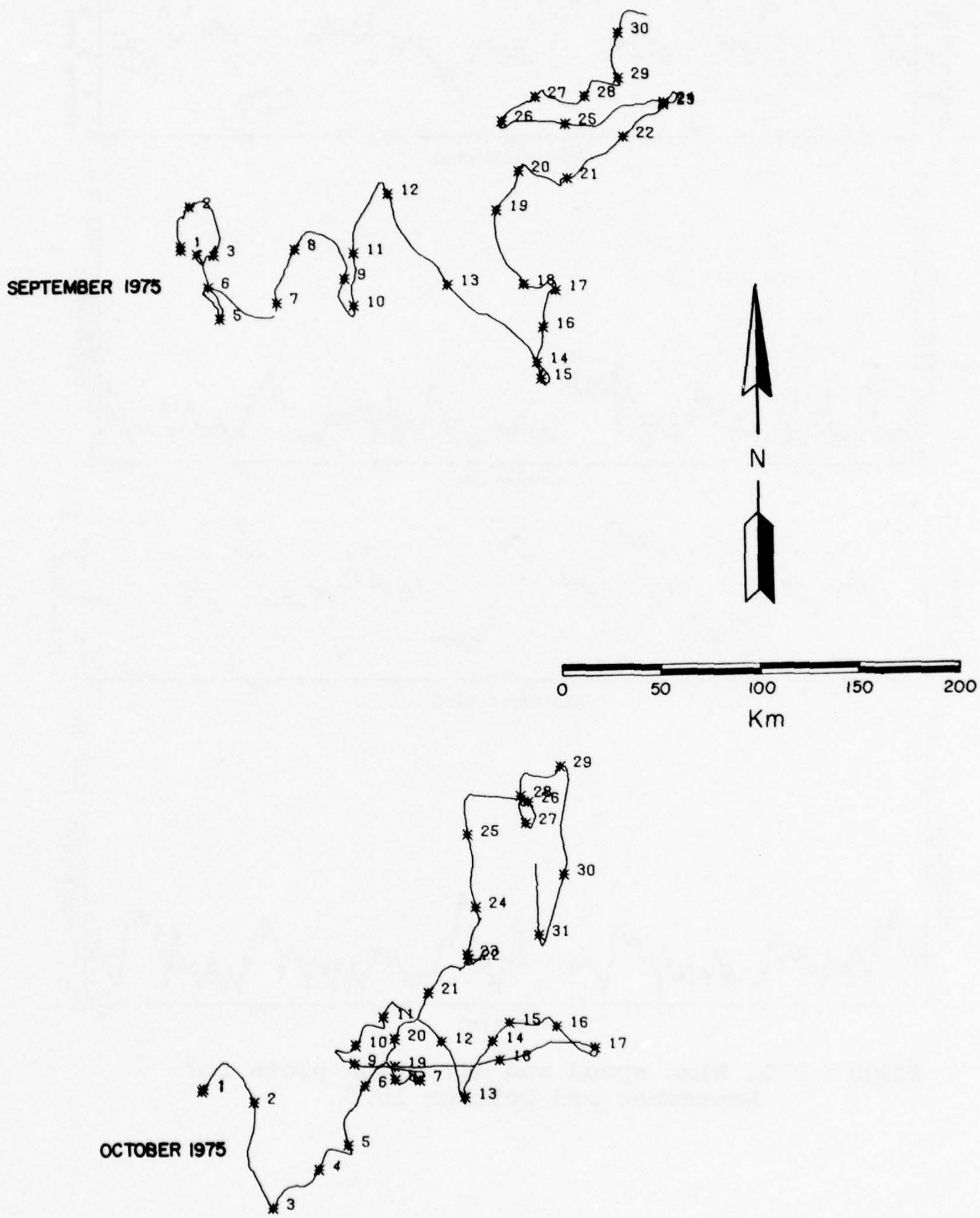
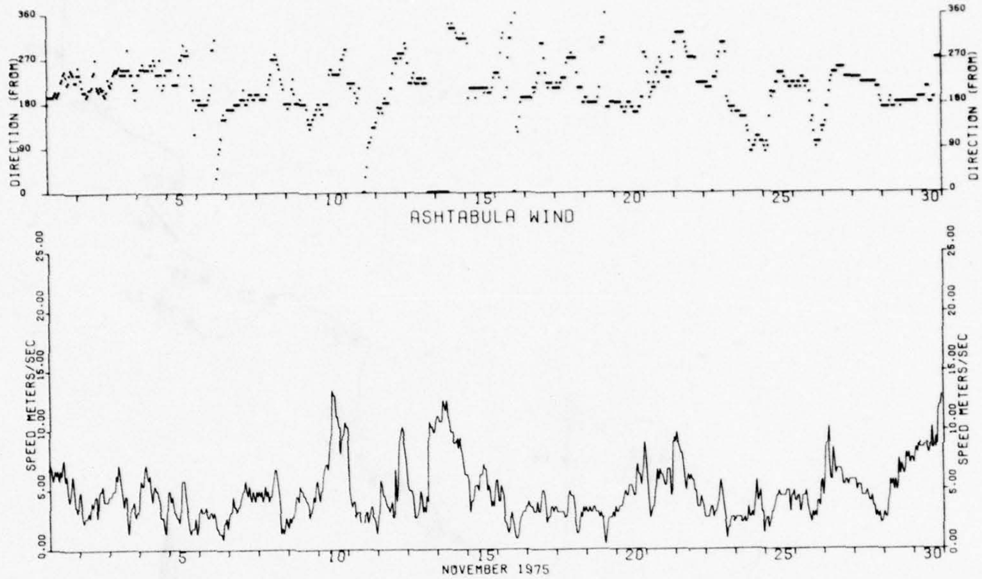


Figure P'4. Progressive vector plots of the wind for September and October 1975



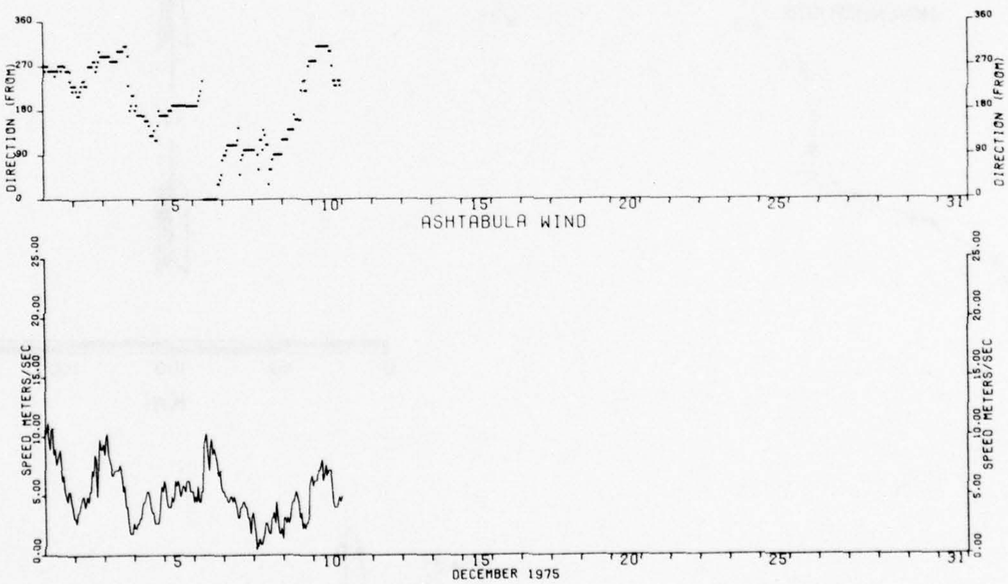


Figure P'5. Wind speed and direction plots for November and December 1975

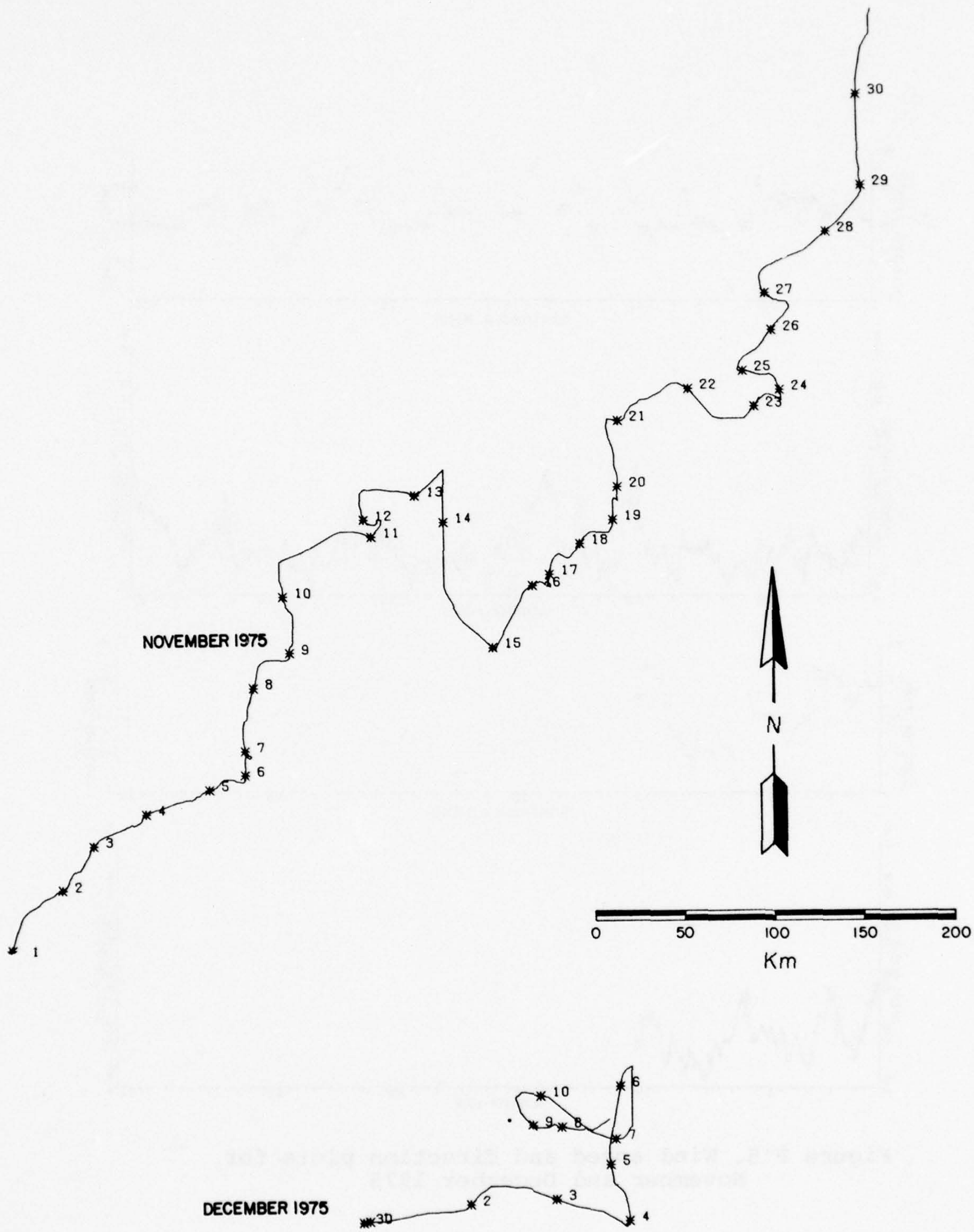


Figure P'6. Progressive vector plots of the wind for November and December 1975

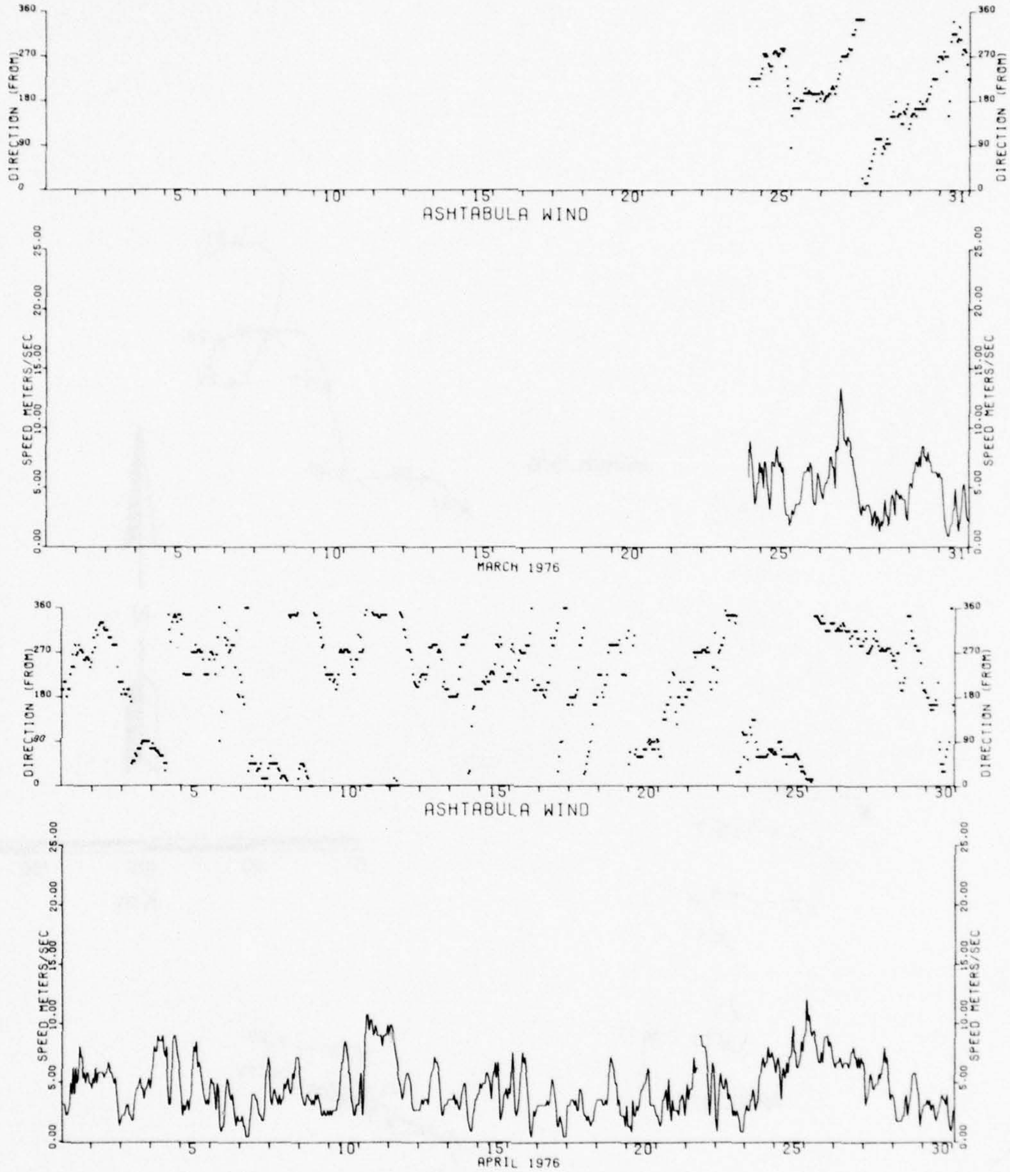


Figure P'7. Wind speed and direction plots for March and April 1976

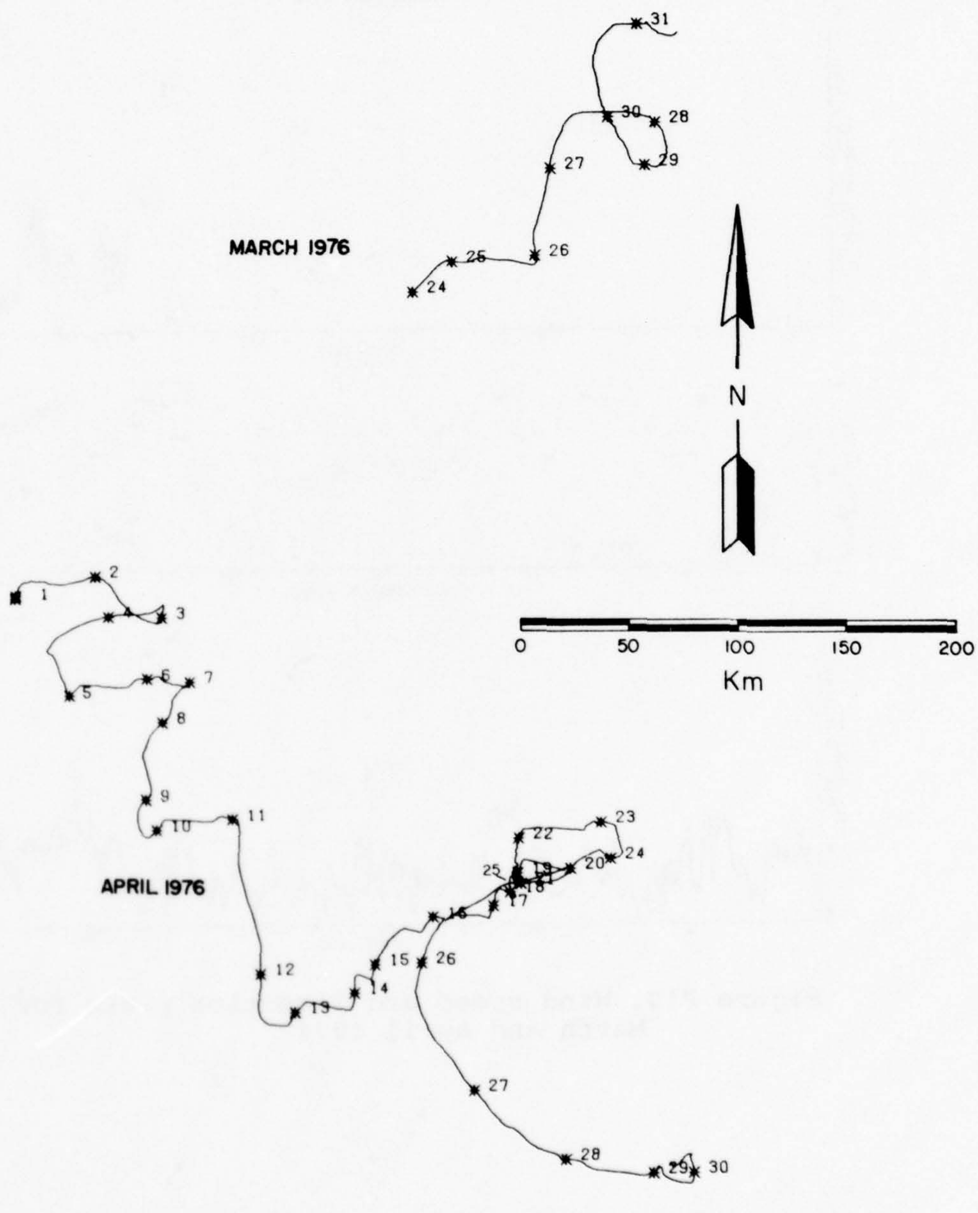


Figure P'8. Progressive vector plots of the wind for March and April 1976

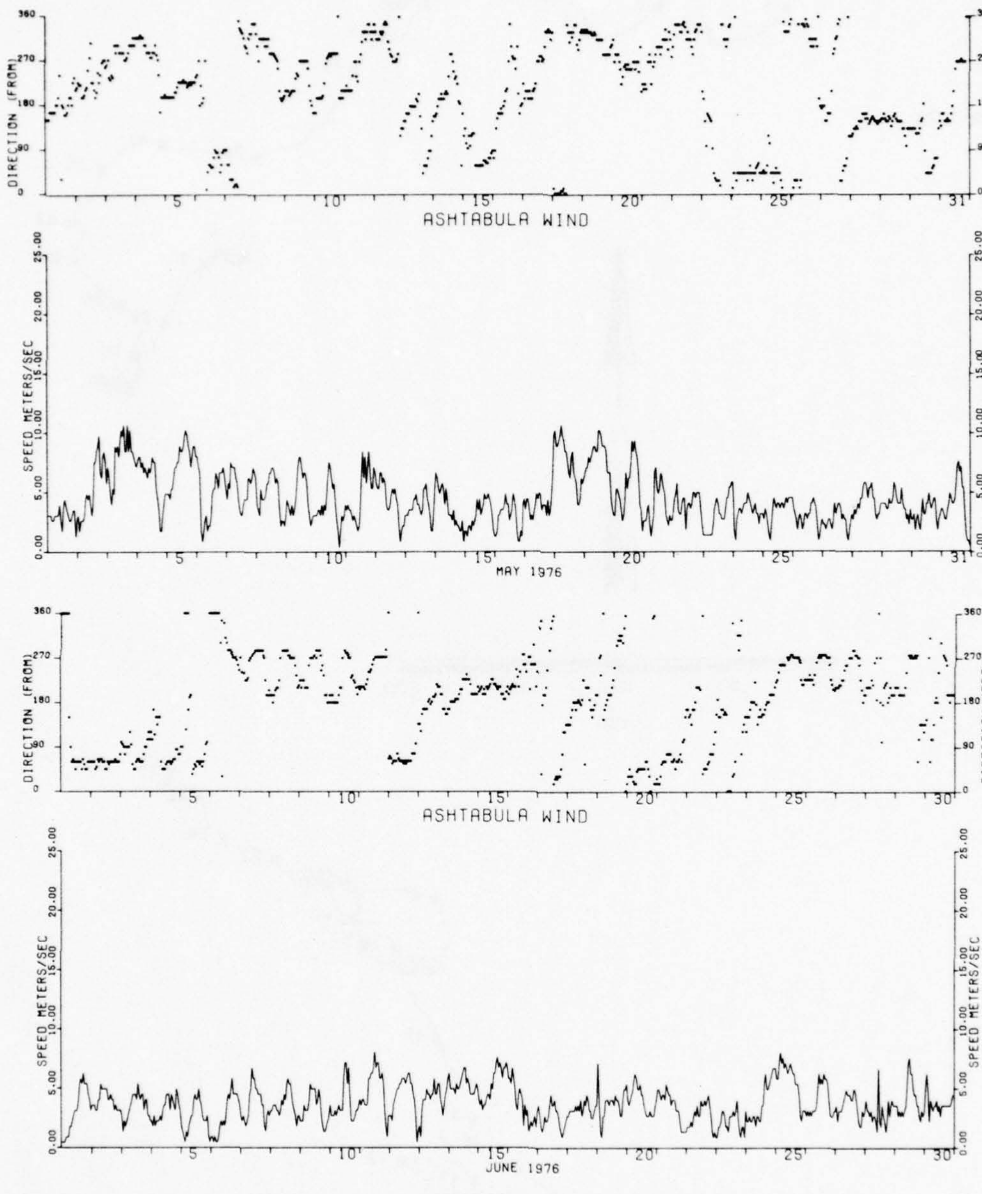


Figure P'9. Wind speed and direction plots for May and June 1976

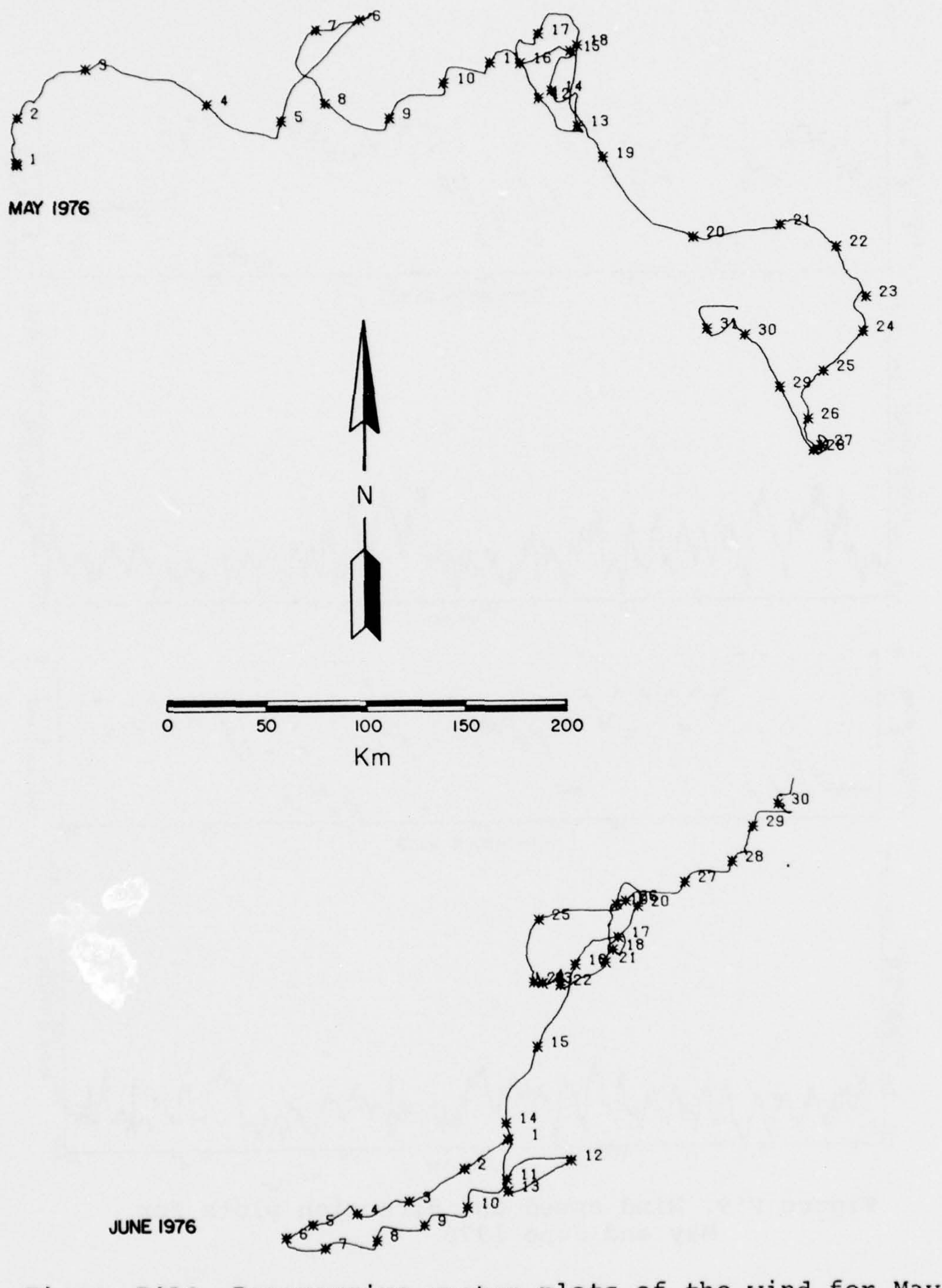


Figure P'10. Progressive vector plots of the wind for May and June 1976

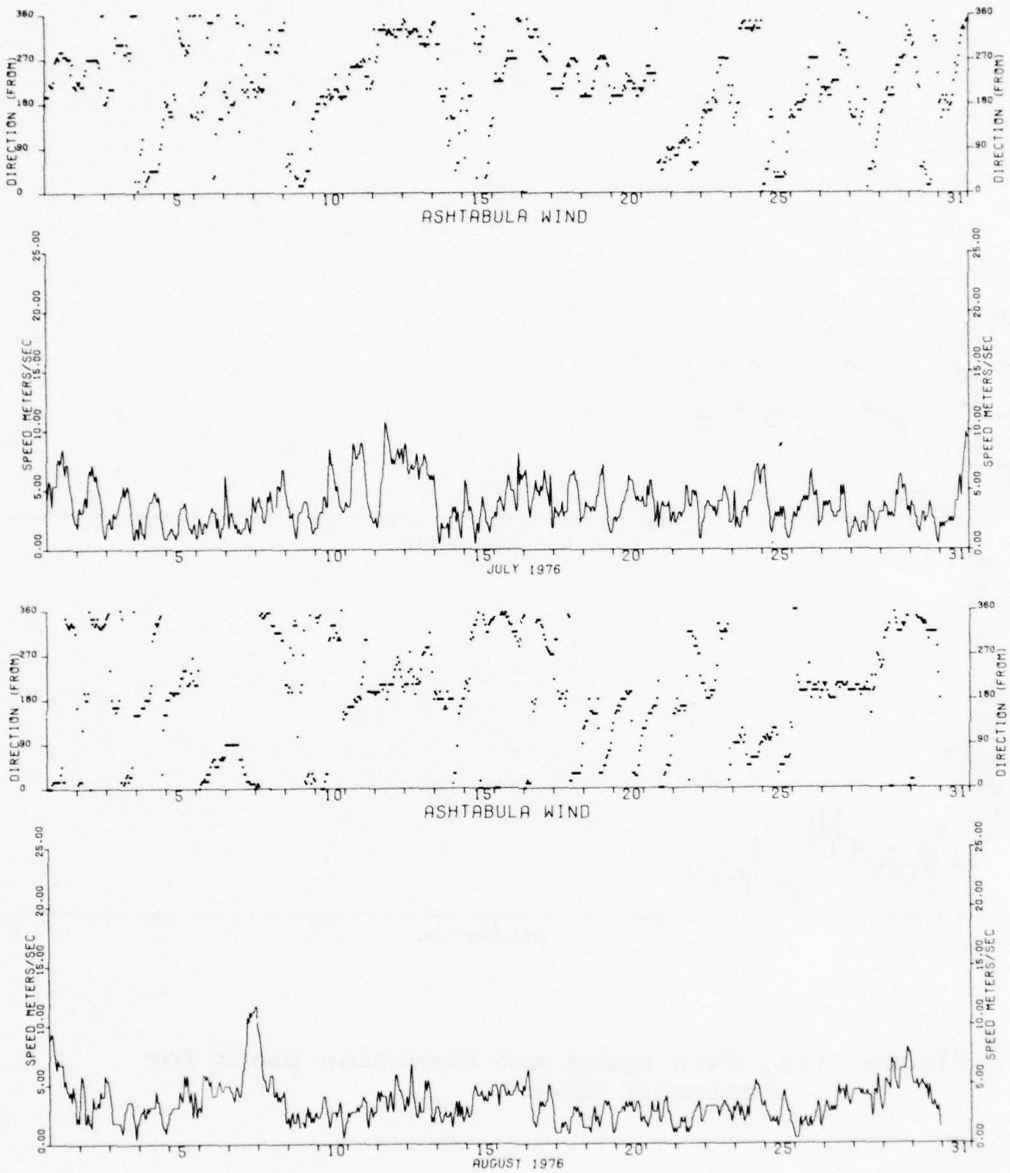


Figure P'11. Wind speed and direction plots for July and August 1976

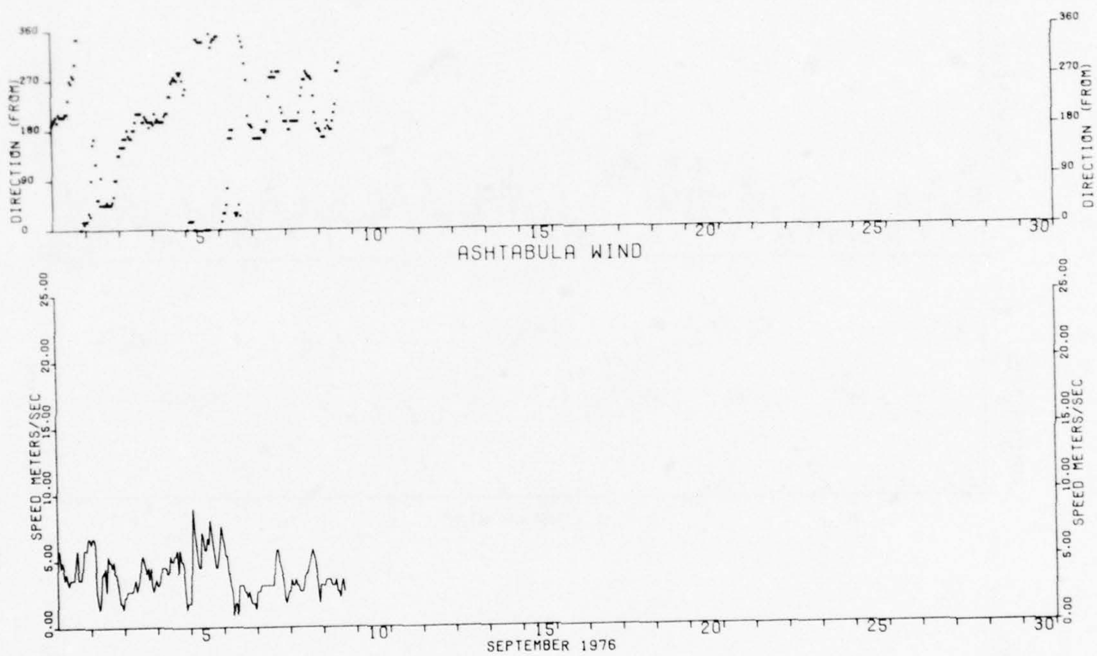


Figure P'12. Wind speed and direction plots for September 1976

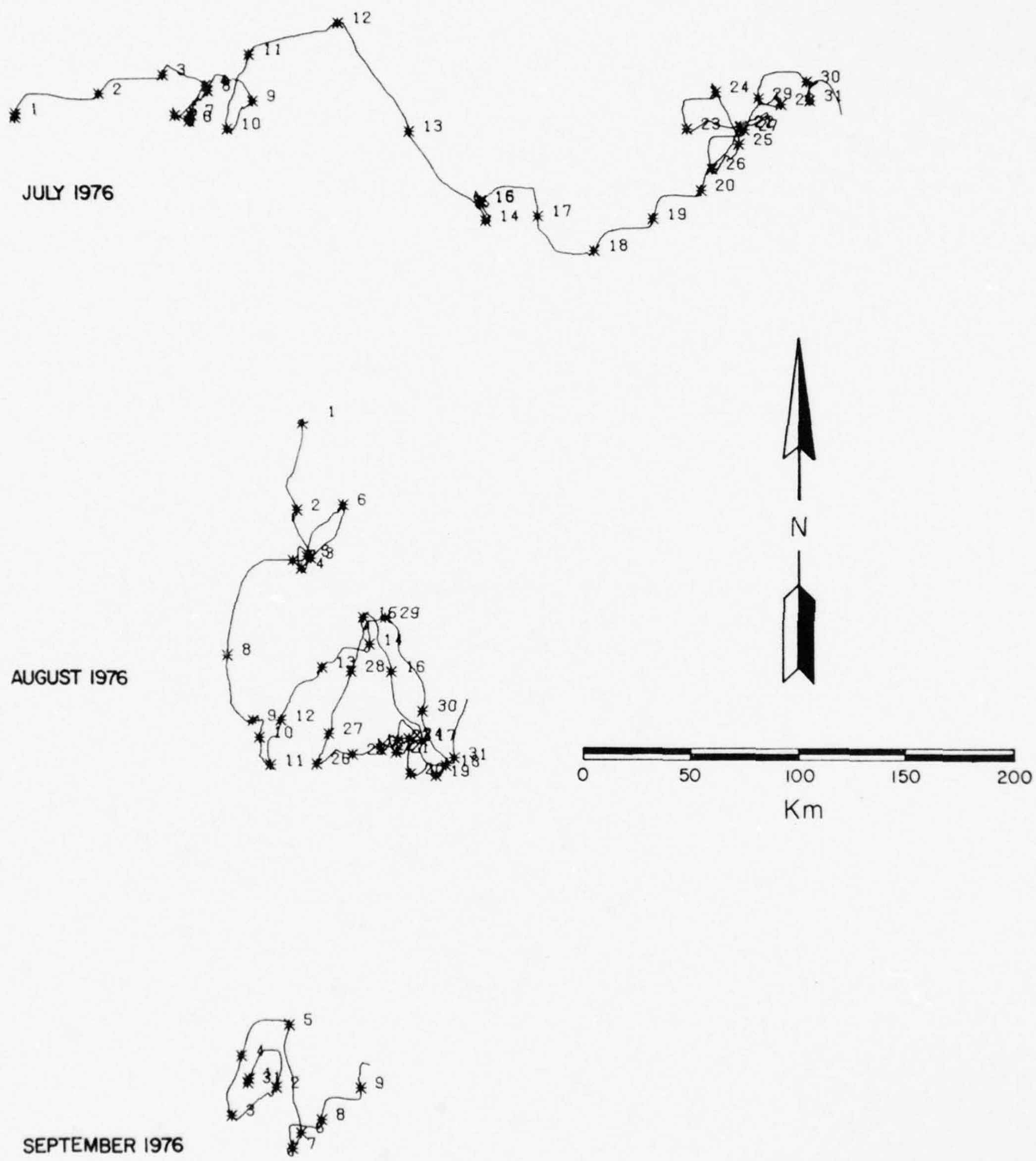


Figure P'13. Progressive vector plots of the wind for July, August, and September 1976

APPENDIX Q': AIR TEMPERATURE TABLES AND PLOTS

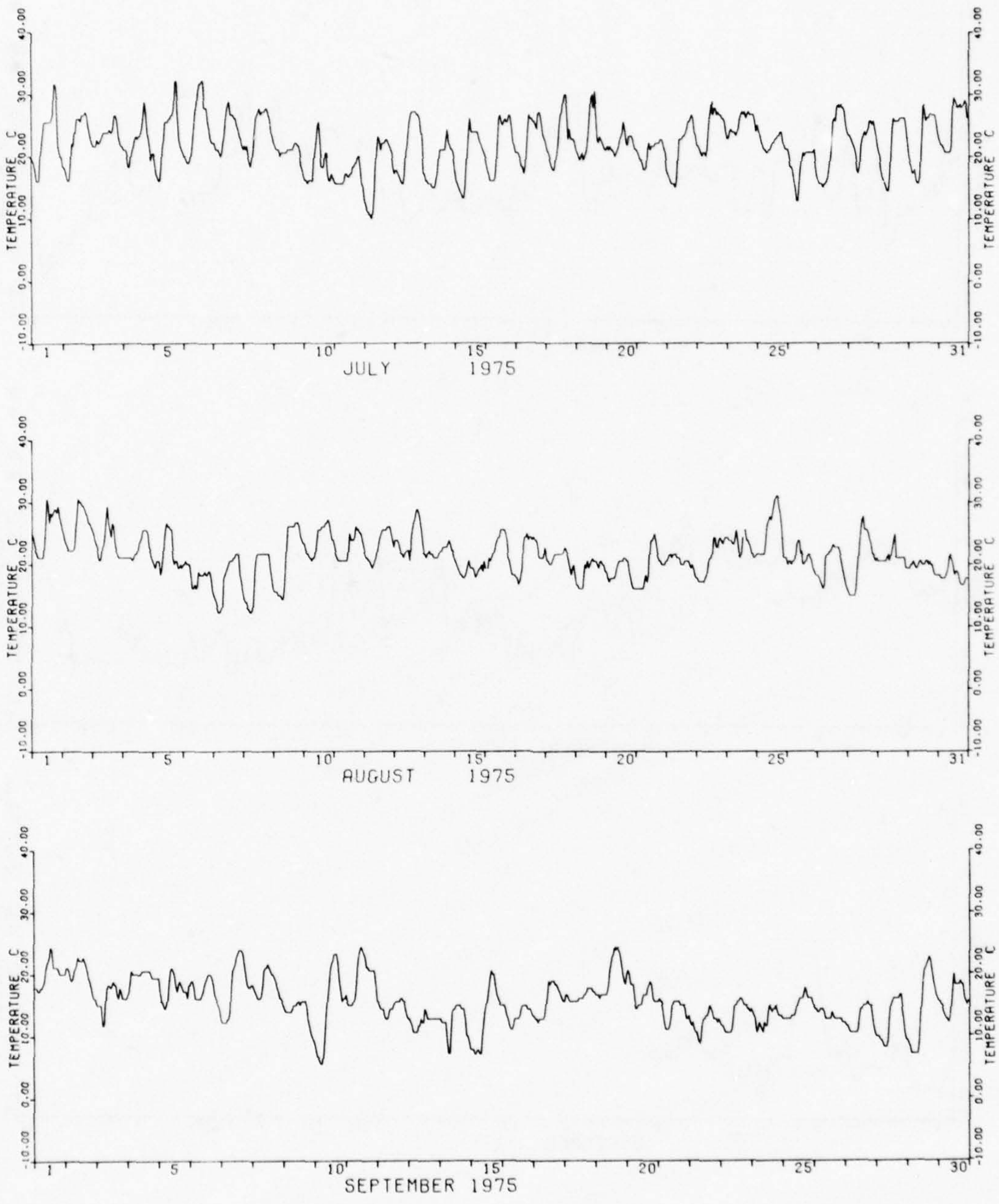


Figure Q'1. Time continuous air temperature (35-ft level) recorded near Ashtabula Harbor for July, August, and September 1975

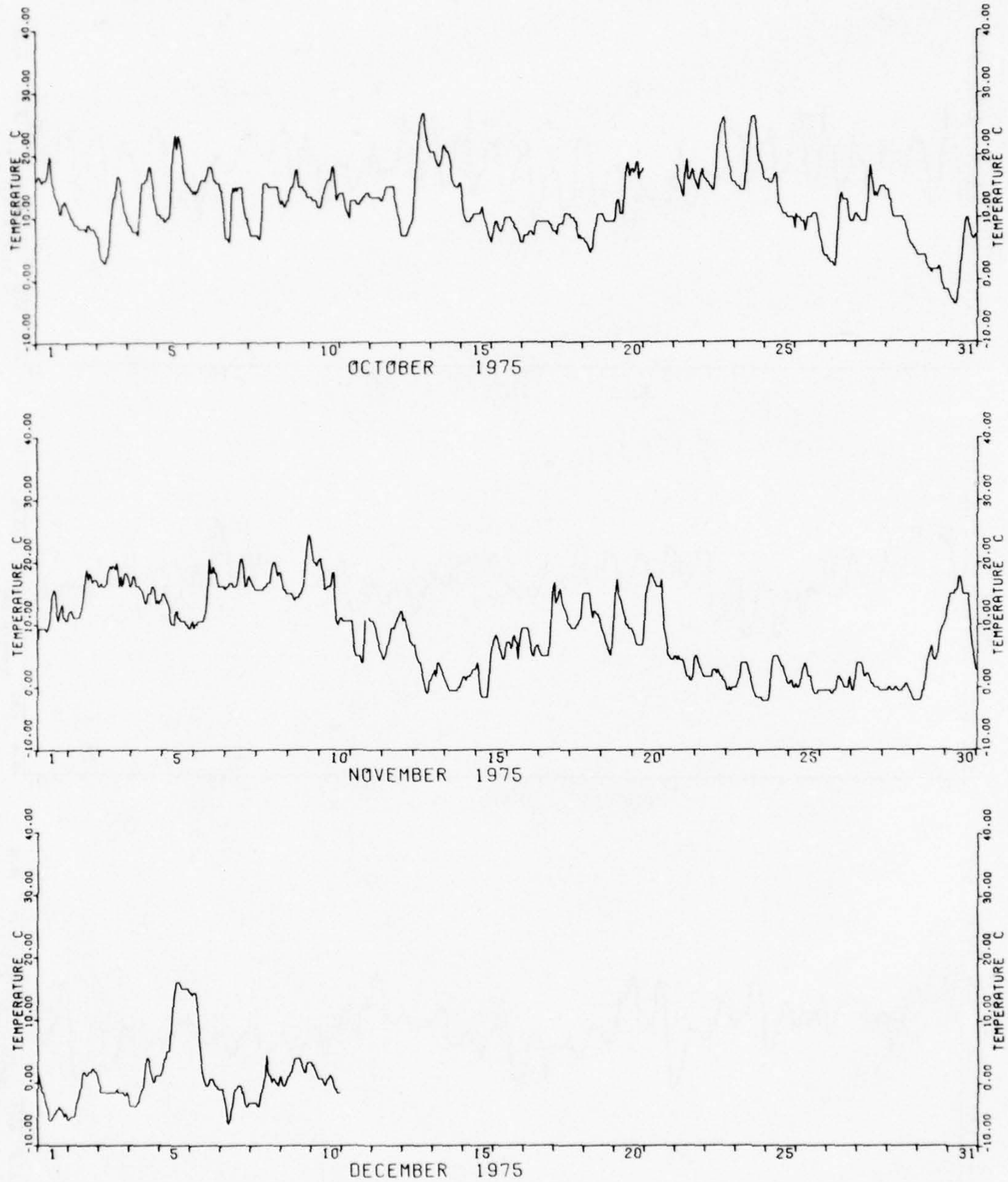


Figure Q'2. Time continuous air temperature (35-ft level) recorded near Ashtabula Harbor for October, November, and December 1975

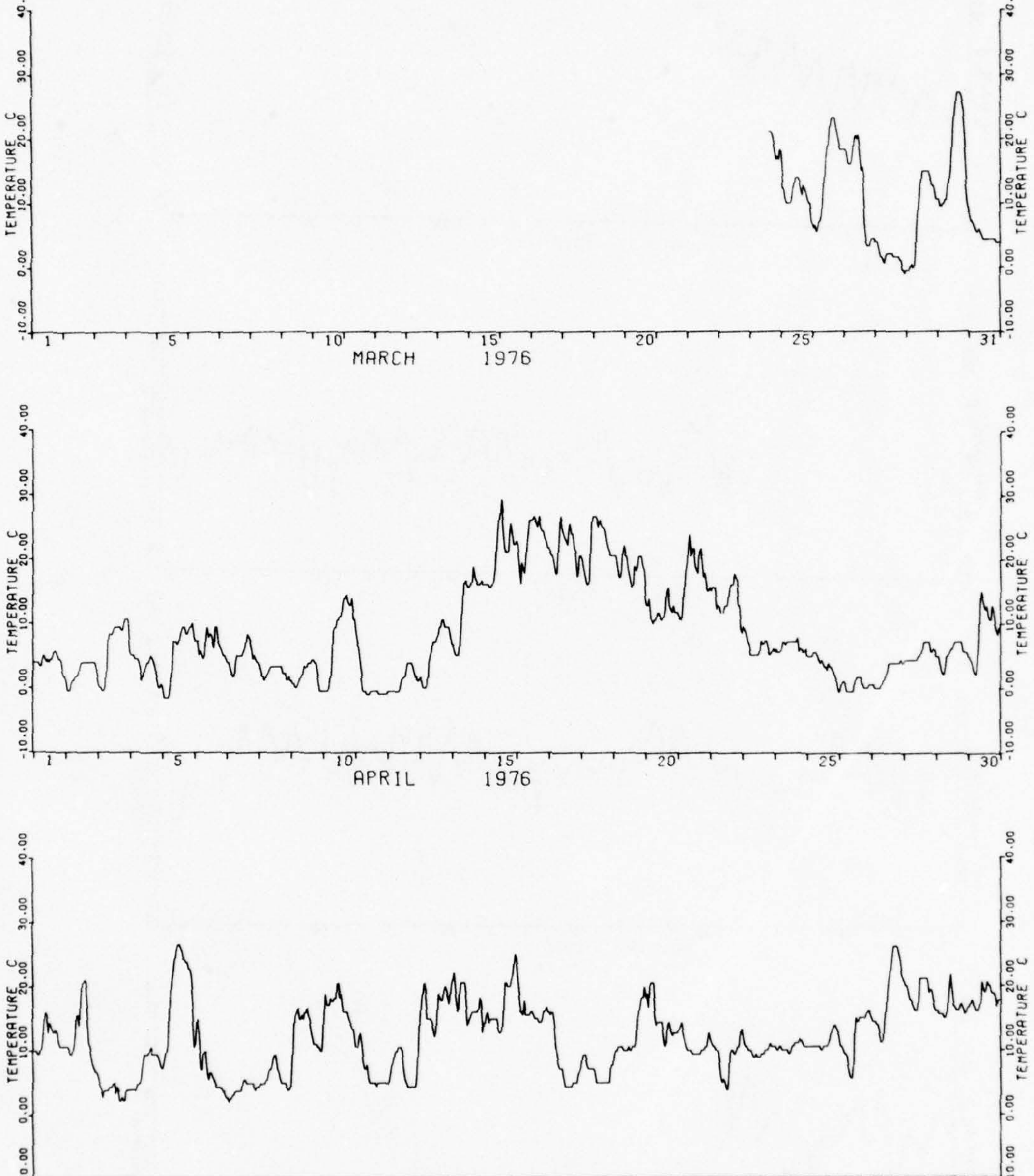


Figure Q'3. Time continuous air temperature (35-ft level) recorded near Ashtabula Harbor for March, April, and May 1976

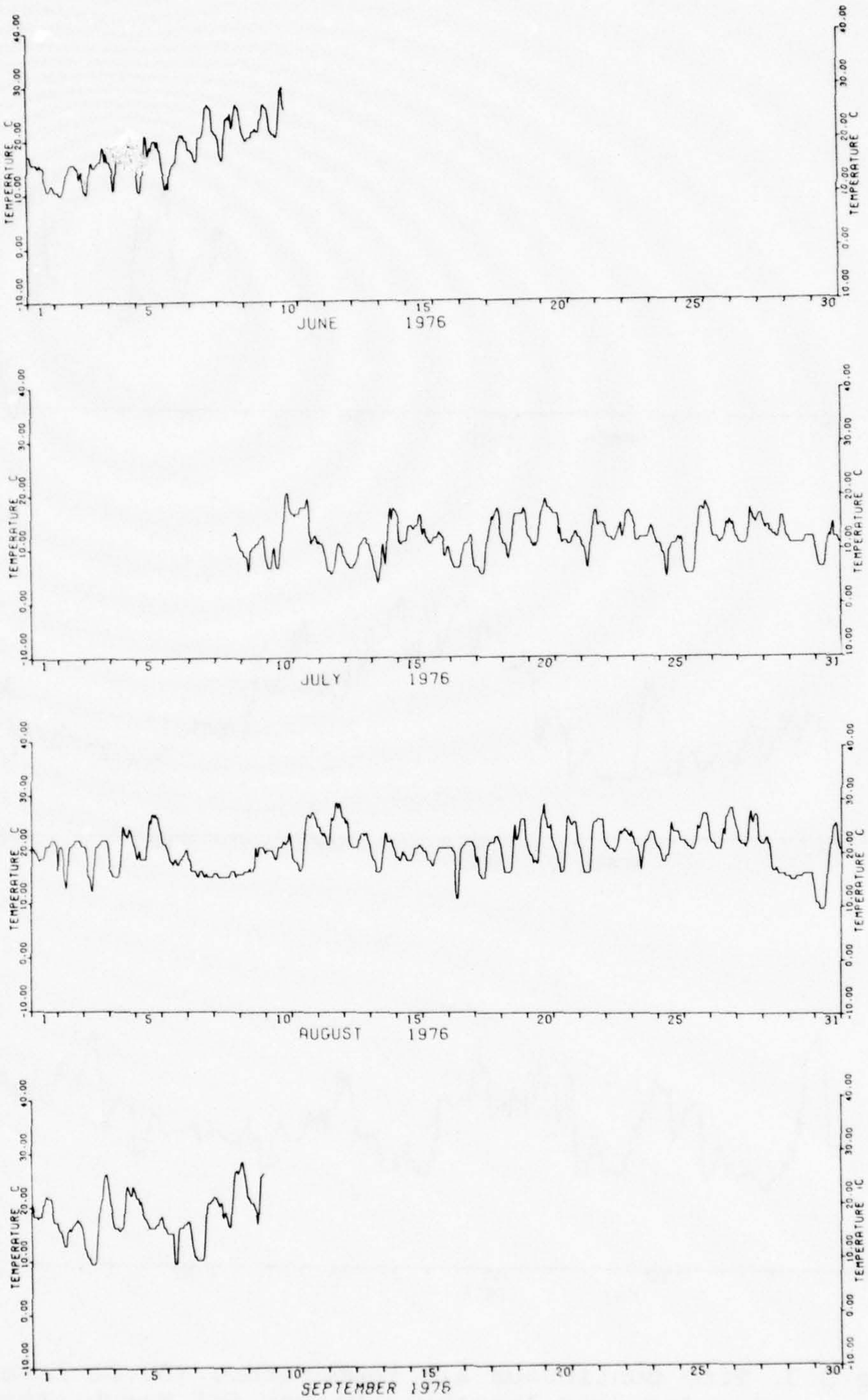


Figure Q'4. Time continuous air temperature (35-ft level) recorded near Ashtabula Harbor for June, July, and August 1976

Table Q'1

Air Temperature (in Degrees Centigrade) for July 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	20	19	19	18	16	16	16	20	22	24	26	26	26	26	26	26	26	27	32	32	29	22	21	20	23
2	20	18	18	18	17	16	16	18	22	22	24	24	26	26	26	26	27	27	27	27	27	25	24	23	23
3	22	22	22	22	23	22	22	23	23	24	24	24	24	24	24	24	24	25	27	27	26	23	22	22	23
4	22	21	21	21	20	18	18	20	21	22	23	23	23	23	23	24	25	27	29	27	24	23	21	19	22
5	21	21	19	17	17	16	16	18	22	23	26	26	26	26	26	27	27	28	32	32	27	23	22	21	23
6	21	20	20	19	19	19	19	21	23	25	27	28	31	32	32	32	32	28	28	28	26	24	23	22	25
7	22	22	21	21	21	21	20	21	22	23	26	27	28	29	27	27	27	26	26	25	24	23	23	22	24
8	21	22	21	22	20	19	18	19	21	24	26	27	27	28	27	27	27	27	28	28	27	26	24	23	24
9	22	22	21	21	21	20	21	21	21	21	21	21	21	21	21	21	22	22	22	22	22	21	18	18	21
10	17	16	16	16	16	16	16	16	19	21	23	25	26	22	18	18	18	21	21	17	16	16	17	17	19
11	16	16	16	16	16	16	16	16	16	17	17	17	17	17	17	18	18	19	19	20	20	18	16	15	17
12	13	12	11	11	11	11	10	12	14	18	21	23	23	21	22	22	22	23	23	22	22	21	21	18	18
13	17	18	18	17	17	16	16	16	17	21	22	24	26	27	27	27	27	27	27	27	26	24	23	17	22
14	17	16	16	16	16	16	15	15	15	16	17	19	21	21	21	21	21	23	24	22	22	21	21	20	19
15	18	16	16	15	14	14	13	13	15	18	21	24	26	24	24	24	24	24	24	23	22	22	21	21	20
16	20	19	18	17	16	16	16	16	17	19	23	26	27	26	25	26	26	26	26	27	27	25	22	22	22
17	21	21	21	20	19	18	18	17	18	22	24	27	26	26	26	26	25	24	27	27	27	25	23	23	23
18	22	21	21	20	19	18	18	18	19	21	22	25	27	27	29	30	30	28	23	24	23	23	23	22	23
19	21	21	20	19	20	21	19	20	21	22	24	27	29	30	28	31	27	23	22	23	23	22	22	21	23
20	21	22	21	22	21	21	21	20	21	21	22	23	23	24	26	24	22	22	23	23	23	23	22	21	22
21	21	21	20	19	19	19	18	18	18	21	22	21	22	22	22	22	22	22	22	23	23	22	21	21	21
22	18	17	17	16	16	16	16	15	16	19	23	23	23	23	23	24	24	26	26	26	27	26	24	23	21
23	22	22	21	21	20	21	21	20	21	24	26	27	29	27	28	28	27	27	27	27	26	26	26	24	24
24	23	23	24	24	24	24	24	23	24	24	26	27	27	27	27	26	27	27	27	27	27	27	26	24	25
25	25	24	23	22	22	21	21	21	21	21	21	22	22	22	23	23	23	23	24	24	22	22	21	21	22
26	21	20	18	18	18	16	15	13	13	16	18	19	21	20	21	21	21	21	21	21	21	21	18	17	19
27	16	16	16	16	15	16	16	16	17	18	20	23	26	26	26	28	28	28	28	28	28	27	25	24	22
28	23	23	23	22	22	21	20	18	17	18	22	23	23	24	23	24	24	26	26	25	26	24	23	22	23
29	21	20	18	17	16	16	15	14	14	17	21	24	26	26	26	26	26	26	26	26	26	26	24	22	22
30	20	19	18	17	17	18	16	15	16	17	21	24	28	27	26	26	26	27	27	27	27	27	25	24	22
31	23	22	22	22	21	21	21	21	21	21	22	27	29	29	28	28	28	28	28	28	28	29	28	26	25
HOURLY MEAN	20	20	19	19	18	18	18	18	19	21	23	24	25	25	25	25	25	25	25	25	25	23	22	21	

MAXIMUM= 32,2 MINIMUM= 10,0 MEAN = 22,0
744, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	31,7	27,2	26,7	28,9	32,2	32,2	28,9	27,8	22,2	25,6	20,0	23,4	27,2	24,5	26,1	
MIN	16,1	16,1	21,7	18,3	16,1	18,9	20,0	18,3	17,8	15,6	15,0	10,0	15,6	15,0	13,3	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	26,7	27,2	30,0	30,6	25,6	22,8	26,7	28,9	27,2	25,0	21,1	28,4	25,6	26,1	28,4	29,5
MIN	16,1	17,2	17,8	19,5	20,0	17,8	15,0	20,0	22,8	20,6	12,8	15,0	17,2	14,5	15,6	20,6

MEAN MAXIMUM= 26,9 MEAN MINIMUM= 17,1

Table Q'2

Air Temperature (in Degrees Centigrade) for August 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	25	24	23	22	22	21	21	21	21	21	24	27	31	29	27	28	28	28	29	29	28	29	28	27	26
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
3	26	25	24	23	23	21	21	21	23	23	25	27	29	27	26	24	27	26	23	22	22	21	21	21	24
4	21	21	21	21	21	21	21	21	21	21	22	22	22	23	24	24	26	26	26	26	25	23	22	21	23
5	21	20	19	21	21	21	18	19	21	24	26	27	26	26	26	26	21	20	21	21	19	19	20	19	22
6	20	20	21	20	20	20	18	16	16	17	16	17	19	18	18	18	16	19	18	18	19	19	18	16	18
7	15	14	14	13	12	12	13	13	18	18	19	19	20	21	21	21	21	21	22	22	22	18	17	16	18
8	14	14	14	13	13	12	12	13	16	19	21	22	22	22	22	22	22	22	22	22	22	19	18	16	18
9	16	16	16	15	15	15	14	14	16	19	23	26	26	26	26	26	26	27	27	27	26	24	24	23	21
10	23	22	22	22	21	21	21	21	21	22	24	26	25	26	26	26	26	27	27	27	27	25	24	24	24
11	23	22	21	21	21	21	21	21	21	21	21	22	25	24	24	24	24	26	26	26	25	25	24	23	23
12	22	21	21	21	21	20	19	20	21	21	22	23	24	25	26	26	26	26	26	26	26	25	24	23	23
13	24	24	24	23	22	22	22	21	22	22	22	22	21	24	26	27	27	28	29	28	27	25	23	22	24
14	22	21	22	22	22	22	22	21	21	21	21	22	22	22	23	23	23	23	23	24	23	22	22	21	22
15	21	20	19	19	18	18	18	18	18	19	20	21	19	19	19	19	18	18	19	19	19	20	19	21	19
16	19	18	19	21	21	21	22	22	23	24	24	24	26	26	26	26	25	24	21	21	19	18	18	18	22
17	18	18	17	17	18	19	23	24	24	25	24	24	24	24	24	24	24	23	22	21	21	21	21	23	22
18	22	21	21	20	20	21	21	22	22	22	22	22	22	22	22	23	22	22	21	19	18	19	20	18	21
19	17	17	16	16	16	16	18	20	19	21	19	20	21	21	21	21	21	20	19	21	21	20	20	19	19
20	19	18	17	18	18	18	18	18	19	20	21	21	21	21	21	21	21	21	19	18	17	16	16	16	19
21	16	16	16	16	16	16	17	18	17	18	22	24	24	24	25	24	22	21	21	21	20	20	20	21	20
22	21	21	22	22	21	22	22	22	21	21	21	20	20	20	21	21	21	21	20	19	20	19	18	18	21
23	18	17	17	17	17	17	18	18	19	21	21	21	22	24	24	23	23	24	24	24	23	24	24	24	21
24	24	24	24	24	23	23	24	26	24	22	21	22	24	26	26	24	24	23	23	22	22	21	21	22	23
25	22	22	22	22	22	22	23	26	27	27	28	27	28	29	31	31	31	29	28	26	22	21	21	21	25
26	20	21	21	20	21	21	21	23	24	24	22	22	20	20	21	21	22	22	21	21	19	19	18	18	21
27	18	18	17	17	16	17	21	22	22	22	22	23	23	23	23	23	23	22	21	20	19	18	17	16	20
28	16	15	15	15	15	15	16	19	21	24	26	27	28	26	26	26	25	24	23	22	22	21	21	21	21
29	21	21	21	21	21	21	21	21	22	21	22	23	24	25	21	21	21	21	21	21	21	21	19	19	21
30	19	19	20	20	21	20	19	19	20	21	21	20	20	20	21	21	20	21	20	20	19	18	18	18	20
31	18	18	18	18	18	18	18	19	20	22	21	21	19	18	19	19	18	17	17	17	17	17	18	18	18
HOURLY MEAN	20	20	19	19	19	19	19	20	21	21	22	23	23	23	23	23	23	23	23	23	22	22	21	21	20

MAXIMUM= 31,1 MINIMUM= 12,2 MEAN = 21,3
720, VALID OBSERVATIONS (96,8%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	30,6	*****	29,5	25,6	26,7	20,6	21,7	21,7	26,7	27,2	26,1	26,1	28,9	23,9	20,6	
MIN	21,1	*****	20,6	20,6	18,3	15,6	12,2	12,2	14,5	20,6	20,6	19,5	20,6	21,1	17,8	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	25,6	25,0	22,8	21,1	21,1	25,0	21,7	24,5	26,1	31,1	23,9	23,4	27,8	25,0	20,6	21,7
MIN	18,3	16,7	18,3	16,1	16,1	16,1	17,8	17,2	21,1	21,1	18,3	16,1	15,0	19,5	18,3	16,7

MEAN MAXIMUM= 24,7 MEAN MINIMUM= 17,9

Table Q'3

Air Temperature (in Degrees Centigrade) for September 1975

	HOUR																								
DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	18	18	18	17	17	18	18	18	19	21	22	22	23	24	24	21	21	21	21	21	20	20	20	20	20
2	20	21	21	21	19	19	19	21	21	22	23	22	22	22	23	22	22	21	19	19	18	17	16	16	20
3	16	15	15	15	15	12	12	15	18	18	18	18	18	19	18	18	17	16	18	17	16	16	16	16	16
4	17	17	19	21	20	20	20	20	20	20	20	21	21	21	21	21	21	21	20	19	19	19	19	19	20
5	19	17	16	16	15	14	15	16	19	21	21	21	20	18	17	18	19	18	18	17	17	17	16	18	18
6	18	19	19	18	16	16	16	16	16	17	17	18	19	19	20	20	20	19	18	17	16	16	15	14	18
7	13	12	12	12	12	13	13	14	18	21	21	22	23	23	24	24	24	23	22	20	18	18	18	18	18
8	18	18	17	17	16	16	16	17	18	21	21	21	22	21	21	20	20	19	19	18	17	16	16	16	18
9	15	14	14	14	14	14	14	14	15	15	15	16	16	15	16	16	16	16	15	13	12	11	10	9	14
10	9	8	7	7	6	6	6	7	11	14	16	18	21	22	22	23	23	23	22	19	17	16	16	16	15
11	17	16	15	15	15	15	16	16	18	21	23	24	24	24	23	23	21	21	21	21	21	21	21	18	20
12	16	16	15	14	14	14	13	13	13	13	14	14	14	15	16	16	16	16	16	16	16	16	14	13	15
13	13	13	12	12	11	11	11	11	12	12	13	12	12	14	14	13	13	13	13	13	13	13	13	13	12
14	13	13	12	12	12	12	9	7	7	11	14	14	14	15	15	15	15	14	14	14	13	10	10	9	12
15	8	8	8	7	7	8	8	7	7	10	12	14	15	16	18	19	21	20	20	18	17	16	16	15	13
16	15	15	15	14	13	13	12	11	11	12	13	13	13	13	13	14	15	15	15	15	14	14	14	14	14
17	13	13	13	13	12	13	13	13	13	13	15	17	19	18	19	19	19	18	18	18	17	17	16	16	16
18	16	17	17	16	16	16	16	16	16	16	16	16	16	16	16	17	17	17	18	18	18	18	17	17	16
19	17	17	17	16	17	17	17	17	17	17	18	21	22	23	23	24	24	24	24	23	22	20	19	18	20
20	20	21	20	18	18	18	16	14	14	15	15	15	16	17	17	17	18	18	19	18	16	16	16	16	17
21	16	16	16	16	14	12	11	11	11	12	13	15	16	16	16	15	16	15	15	15	15	14	13	13	14
22	13	12	12	12	11	11	11	9	9	9	12	13	13	13	13	14	15	14	14	13	13	13	12	13	12
23	12	12	12	11	11	11	11	11	11	11	13	15	15	16	16	16	15	16	15	15	15	14	14	14	13
24	14	14	13	13	11	11	12	12	11	11	12	12	12	14	15	14	14	14	14	15	14	13	13	13	13
25	13	13	13	13	13	13	13	13	13	13	14	15	16	16	16	16	17	18	17	16	16	16	16	15	15
26	15	14	14	14	14	14	14	14	14	13	13	13	13	13	14	13	13	13	13	13	13	13	12	12	13
27	12	12	12	11	11	11	11	11	11	11	11	13	14	14	15	15	15	16	15	15	15	13	12	11	13
28	10	10	10	9	9	9	8	8	8	9	13	15	16	16	16	16	16	16	17	17	14	13	11	9	12
29	9	9	8	7	7	7	7	7	7	9	13	16	19	21	21	22	22	23	22	21	19	18	17	16	14
30	16	16	15	15	14	13	13	13	12	13	15	18	20	18	18	18	18	19	18	18	16	16	15	16	15
OURLY EAN	15	14	14	14	13	13	13	13	14	15	16	17	17	18	18	18	18	18	18	17	16	16	15	15	

MAXIMUM= 24,5 MINIMUM= 5,6 MEAN = 15,6
720, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	24,5	22,8	18,9	20,6	21,1	20,0	23,9	21,7	15,6	23,4	24,5	16,1	14,5	15,0	20,6
MIN	17,2	16,1	11,7	16,7	14,5	14,5	12,2	15,6	9,5	5,6	15,0	12,8	10,6	7,2	7,2
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	15,0	18,9	17,8	24,5	20,6	16,1	15,0	16,1	15,0	17,8	15,0	15,6	16,7	22,8	20,0
MIN	11,1	12,2	15,6	16,1	14,5	11,1	8,9	10,6	10,6	12,8	12,2	10,6	8,3	7,2	12,2

MEAN MAXIMUM= 19,0 MEAN MINIMUM= 12,0

Table Q'4

Air Temperature (in Degrees Centigrade) for October 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	16	16	17	17	16	16	16	16	16	17	18	20	19	16	15	14	13	13	12	11	11	12	12	13	15
2	12	12	11	11	10	10	9	9	9	9	8	8	8	8	8	8	8	9	9	8	8	8	8	8	9
3	7	7	6	4	3	3	3	3	4	4	6	8	11	12	13	13	15	17	17	16	14	13	11	11	9
4	10	9	9	9	8	8	8	8	8	7	10	13	16	16	16	16	16	17	18	18	17	15	13	12	12
5	11	11	11	10	10	10	9	9	10	10	11	13	18	21	22	23	21	23	23	22	20	18	16	16	15
6	16	15	15	14	14	14	14	14	14	15	16	16	16	16	16	17	17	18	18	16	18	16	16	16	16
7	16	16	14	14	13	10	7	7	7	6	8	13	15	14	15	14	15	15	15	15	13	11	10	10	12
8	9	8	7	7	7	7	7	7	7	7	8	11	16	16	16	16	15	15	15	15	15	15	15	15	11
9	14	13	12	13	17	12	12	13	13	14	15	15	16	17	18	18	15	15	15	15	14	14	14	13	14
10	13	13	13	13	13	13	13	12	12	12	12	13	14	15	16	16	16	16	17	16	18	15	13	13	14
11	14	14	14	14	13	12	11	11	10	13	13	13	13	13	12	12	12	13	13	13	13	14	14	14	13
12	13	13	13	13	13	13	13	13	13	13	13	13	14	15	15	15	15	15	15	15	13	12	11	10	14
13	9	7	7	7	7	7	8	8	9	9	10	13	16	18	21	23	25	26	27	27	24	23	22	21	16
14	21	21	21	21	19	19	18	18	19	19	21	****	****	****	****	****	****	****	****	****	****	****	****	****	20
15	****	****	****	****	****	****	****	****	****	****	****	22	21	21	21	20	19	16	16	15	15	15	15	16	18
16	16	13	11	10	9	9	9	9	10	10	11	11	11	11	11	11	11	12	10	9	9	8	7	7	10
17	6	7	8	9	9	9	8	8	8	8	9	10	10	10	10	10	9	9	9	8	8	8	7	6	9
18	6	6	7	7	7	7	8	8	8	7	7	9	9	9	9	9	9	9	9	9	9	9	9	9	8
19	8	8	8	8	7	9	9	9	9	9	11	11	11	11	11	10	10	10	9	9	8	7	7	7	9
20	7	7	6	6	6	5	4	5	5	7	8	9	11	11	11	11	11	10	9	9	9	9	9	9	8
21	9	9	10	12	13	13	11	11	11	13	16	18	19	18	17	18	18	17	18	19	19	16	17	17	15
22	18	17	18	18	16	16	15	14	13	16	18	19	16	16	17	18	17	16	16	15	14	16	17	16	16
23	17	16	16	16	16	15	15	14	14	16	18	21	23	24	25	26	26	25	21	20	18	18	16	16	19
24	16	16	15	15	15	14	14	14	14	16	18	21	23	24	26	26	26	26	24	21	19	19	18	17	19
25	16	16	16	16	16	16	16	16	17	17	17	12	12	12	11	11	11	11	10	10	10	10	10	10	13
26	8	11	10	10	10	9	9	9	8	9	10	10	10	10	11	11	11	11	9	8	7	6	4	4	9
27	4	4	3	3	3	3	3	2	2	5	8	11	13	14	13	13	13	13	12	10	9	9	9	10	8
28	11	11	10	10	9	9	9	9	9	11	13	16	18	17	16	13	14	13	14	14	15	15	15	15	13
29	14	14	14	13	13	11	10	10	10	10	10	10	10	10	9	9	8	8	7	6	6	6	5	5	10
30	4	4	4	4	4	4	4	4	3	2	2	2	1	2	2	2	2	2	2	2	0	0	-1	-1	2
31	-1	-1	-1	-2	-2	-2	-3	-3	-2	-1	0	2	4	6	8	9	10	10	9	8	7	7	7	7	3
OURLY EAN	11	11	11	11	10	10	10	10	10	10	11	13	14	14	14	14	14	14	14	14	13	12	12	11	

MAXIMUM= 26.7 MINIMUM= -3.9 MEAN = 12.0
720, VALID OBSERVATIONS (96.8%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	20.0	12.2	16.7	18.3	23.4	18.3	15.6	15.6	17.8	18.3	13.9	15.0	26.7	21.1	21.7	
MIN	10.6	7.8	2.8	7.2	9.5	13.9	6.1	6.7	11.7	11.7	[illegible]	10.0	7.2	18.3	15.0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	15.6	10.0	9.5	10.6	10.6	18.9	19.5	26.1	26.1	17.2	10.6	13.9	18.3	14.5	4.4	10.0
MIN	6.7	6.1	6.1	6.7	4.4	9.5	13.3	14.5	14.5	10.0	3.9	2.2	9.5	5.0	-1.7	-3.9

MEAN MAXIMUM= 16.5 MEAN MINIMUM= 8.2

Table Q'5

Air Temperature (in Degrees Centigrade) for November 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
	HOUR																								
1	7	9	9	9	9	9	9	9	9	10	11	14	15	16	15	12	11	12	13	13	11	11	11	11	11
2	12	12	12	12	11	11	11	11	11	12	13	14	16	18	19	17	18	18	17	17	17	17	17	16	15
3	16	17	16	16	16	17	18	19	19	19	19	19	19	20	18	16	18	16	17	16	18	18	17	16	18
4	16	18	18	17	16	16	16	16	16	15	14	13	14	15	15	15	16	16	16	13	14	13	14	14	15
5	15	15	14	14	13	13	11	10	10	10	12	12	11	11	11	11	11	11	10	10	9	9	10	11	11
6	9	10	10	11	11	11	11	11	11	12	14	17	21	18	18	19	18	18	17	16	16	16	16	16	14
7	16	16	16	17	17	17	16	16	16	17	18	19	21	21	19	16	16	17	18	17	17	16	16	16	17
8	16	16	16	16	16	16	16	16	17	17	17	18	19	20	20	19	16	18	18	17	16	16	16	15	17
9	15	15	15	15	14	14	14	14	14	15	15	16	17	19	22	23	24	24	22	21	20	20	19	20	18
10	21	21	19	18	16	16	16	16	16	17	18	18	13	11	10	11	11	11	11	11	11	11	11	11	14
11	11	11	7	6	5	5	5	5	4	4	7	11	12	13	11	11	11	11	10	9	8	7	6	6	8
12	5	4	5	6	7	7	8	9	9	9	10	11	11	12	12	12	11	11	11	9	9	7	7	7	9
13	7	7	5	4	4	4	3	2	1	0	0	0	1	1	2	2	3	2	4	4	3	3	2	2	3
14	1	1	0	0	0	0	0	0	0	0	0	0	1	1	2	2	1	2	2	2	2	3	3	3	1
15	3	4	2	0	-1	-1	-1	-1	-1	0	2	5	6	7	8	8	8	7	6	6	4	4	5	7	3
16	7	7	7	6	8	8	7	7	4	7	8	9	9	9	9	9	9	7	6	5	5	6	7	7	7
17	6	6	5	5	5	5	5	5	7	9	13	16	17	13	14	14	16	15	13	13	12	12	11	10	10
18	10	9	9	9	9	10	10	11	11	13	15	15	15	15	15	15	13	11	12	12	12	12	11	11	12
19	9	9	8	7	7	6	6	5	7	9	13	16	17	15	14	14	13	12	11	10	10	9	9	9	10
20	9	8	7	7	7	7	7	7	8	11	14	16	17	18	18	18	17	17	16	16	16	16	17	13	13
21	9	8	7	5	5	4	4	4	5	5	4	5	4	4	4	4	3	2	2	2	1	1	2	4	4
22	5	5	4	3	3	2	2	2	2	2	2	2	2	3	3	3	2	3	2	2	2	1	1	1	2
23	0	0	0	0	0	0	0	0	1	1	2	4	4	4	4	4	3	2	2	1	0	0	-1	-1	1
24	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	3	4	5	5	5	5	4	4	3	3	2	2	1	1	1
25	1	1	1	0	0	1	0	0	1	2	3	3	4	3	2	2	2	1	0	0	0	0	0	0	1
26	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	1	0	0	0	0	2	1	0
27	0	0	1	3	4	4	4	4	3	2	2	2	2	2	1	1	1	0	0	0	0	0	0	0	1
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	-1	-1	0
29	-1	-1	-1	-1	-1	-1	0	0	1	3	4	5	6	7	5	4	4	5	6	8	9	9	10	11	3
30	11	13	13	15	15	15	15	16	16	16	18	18	17	15	15	15	15	15	13	9	7	6	4	3	13
HOURLY MEAN	8	8	7	7	7	7	7	7	7	8	9	10	10	11	10	10	10	10	9	9	8	8	8	8	

MAXIMUM= 24.5 MINIMUM= -2.2 MEAN = 8.5
720. VALID OBSERVATIONS (100.0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	15.6	18.9	20.0	17.8	15.0	20.6	20.6	20.0	24.5	20.6	12.8	12.2	6.7	2.8	8.3
MIN	7.2	11.1	16.1	13.3	9.5	9.4	15.6	15.0	13.9	10.0	3.9	4.4	-1.1	-0.6	-1.7

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	9.5	16.7	15.0	17.2	18.3	9.5	5.0	3.9	5.0	3.9	1.7	3.9	0.6	10.6	17.8
MIN	4.4	5.0	9.5	5.0	6.7	1.1	0.6	-1.7	-2.2	-1.1	-1.1	-0.6	-2.2	-2.2	2.8

MEAN MAXIMUM= 12.5 MEAN MINIMUM= 5.0

Table Q'6

Air Temperature (in Degrees Centigrade) for 1 through 10 December 1975

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	2	1	0	0	-1	-1	-2	-3	-3	-5	-5	-5	-5	-4	-4	-3	-3	-3	-3	-3	-4	-5	-4	-5	-3
2	-5	-5	-5	-5	-5	-5	-3	-2	-2	-1	0	1	2	2	1	1	2	2	2	2	2	2	2	1	0
3	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
4	-1	-3	-3	-3	-3	-3	-3	-2	-2	-1	-1	0	1	2	4	4	3	2	1	0	0	1	1	1	0
5	1	1	2	2	4	4	5	5	5	7	9	12	14	15	16	16	16	16	15	15	15	15	15	15	10
6	14	14	14	14	14	14	13	11	7	4	2	1	0	0	0	0	1	1	1	0	0	0	0	0	5
7	0	0	0	-1	-2	-3	-5	-6	-5	-3	-3	-2	0	0	0	0	0	0	-1	-1	-2	-3	-3	-2	-2
8	-2	-2	-2	-2	-2	-2	-3	-3	-2	-1	0	1	1	****	2	1	1	0	1	1	0	0	0	1	0
9	1	0	0	0	0	1	1	1	2	2	3	4	4	4	4	4	3	3	2	2	2	3	3	3	2
10	3	3	3	2	2	1	1	1	1	1	0	0	0	1	1	1	1	1	0	0	0	-1	-1	-1	0
HOURLY MEAN	1	0	0	0	0	0	0	0	0	0	0	1	1	2	2	2	2	2	1	1	1	1	1	1	

MAXIMUM= 16.1 MINIMUM= -6.7 MEAN = 0.7
239. VALID OBSERVATIONS (99.6%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10
MAX	1.7	2.2	0.0	3.9	16.1	14.5	-0.6	1.7	3.9	3.3
MIN	-6.1	-6.1	-2.2	-3.9	1.1	-1.1	-6.7	-3.9	-0.6	-1.7

MEAN MAXIMUM= 4.7 MEAN MINIMUM= -3.1

Table Q'7

Air Temperature (in Degrees Centigrade) for March 1976

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
3	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
4	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
5	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
6	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
7	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
8	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
9	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
10	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
11	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
13	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
14	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
15	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
16	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
17	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
18	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
19	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
20	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
21	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
22	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
23	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
24	****	****	****	****	****	****	****	****	****	****	****	****	****	****	21	21	21	21	19	18	17	17	17	18	19
25	18	12	12	11	10	10	10	10	11	12	13	14	14	14	13	12	11	13	12	12	11	10	10	7	12
26	7	6	7	6	6	7	7	8	11	14	17	18	19	22	22	23	23	23	22	21	19	18	18	18	15
27	18	18	18	16	16	16	17	18	20	21	20	21	18	15	16	14	6	4	3	3	3	4	4	4	13
28	4	4	4	3	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1	0	0	0	2
29	0	0	0	0	1	0	0	2	6	8	11	13	15	15	15	15	15	15	14	13	13	13	12	11	9
30	11	11	9	9	10	10	11	11	12	14	16	18	22	24	26	27	27	27	27	26	24	20	13	10	17
31	9	8	7	7	7	6	6	6	6	6	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5
HOURLY MEAN	9	8	8	.7	7	7	7	8	10	11	12	13	14	14	15	15	14	14	13	12	12	11	10	9	

MAXIMUM= 27,2 MINIMUM= -1,1 MEAN = 10,9
178, VALID OBSERVATIONS (23,9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
MIN	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	*****	*****	*****	*****	*****	*****	*****	*****	21,1	17,8	23,4	20,6	3,9	15,0	27,2	8,9
MIN	*****	*****	*****	*****	*****	*****	*****	*****	16,7	7,2	5,6	3,3	-1,1	-0,6	9,5	3,9

MEAN MAXIMUM= 17,2 MEAN MINIMUM= 5,6

Table Q'8

<u>Air Temperature (in Degrees Centigrade) for April 1976</u>

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	4	4	4	4	4	3	3	4	5	4	4	4	4	4	4	5	6	6	5	4	4	4	2	2	4
2	2	1	0	0	0	1	1	1	2	2	2	3	4	4	4	4	4	4	4	4	4	4	4	3	2
3	2	1	0	0	0	0	0	3	7	8	8	8	9	9	9	9	9	9	9	9	10	11	11	11	6
4	6	5	5	5	4	4	4	4	3	1	2	3	3	4	4	4	5	4	4	3	2	1	0	0	3
5	1	0	-1	-1	-1	-1	0	1	4	7	7	7	7	7	8	9	9	9	8	8	9	9	9	10	5
6	8	7	7	7	5	6	5	4	5	6	9	8	8	7	7	6	9	9	7	7	6	6	5	5	7
7	4	4	4	3	2	2	2	4	5	5	5	5	5	6	6	7	8	8	7	6	4	5	4	4	5
8	4	3	2	2	2	1	2	2	3	3	3	3	3	3	3	3	3	3	2	2	2	2	1	2	3
9	1	1	1	1	0	0	1	1	2	2	3	3	3	4	4	4	4	4	4	4	2	1	0	0	2
10	0	0	0	0	0	0	2	4	9	9	9	11	11	11	11	13	14	14	14	13	13	13	14	11	8
11	11	8	7	6	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12	0	0	0	0	0	0	0	0	0	0	0	1	2	2	3	4	4	4	4	3	2	2	2	1	1
13	1	2	1	0	0	0	1	4	5	6	7	7	7	8	8	9	9	11	11	9	9	9	9	8	6
14	7	7	6	5	5	5	7	9	13	16	17	16	16	16	16	17	19	17	17	16	16	16	17	16	13
15	16	16	16	16	16	16	16	17	18	21	24	26	27	29	25	22	21	21	21	24	26	24	22	22	21
16	23	22	19	16	19	18	18	20	23	24	26	26	26	27	26	26	25	27	25	24	24	23	23	22	23
17	22	21	21	21	17	18	18	21	24	27	25	24	23	23	22	24	26	24	24	22	21	17	18	21	22
18	21	20	18	17	16	16	17	21	26	27	27	27	26	25	26	26	25	25	24	23	22	21	21	21	22
19	21	21	21	19	17	17	18	21	22	21	21	18	17	16	16	16	19	18	19	21	21	21	19	18	19
20	14	13	13	14	11	11	10	11	11	12	12	11	11	11	11	12	15	16	13	12	12	13	12	12	12
21	12	11	11	11	13	16	18	19	22	24	21	22	22	19	18	18	21	22	20	17	18	16	15	15	17
22	16	15	16	16	16	12	13	13	12	10	12	13	13	13	14	16	16	16	18	17	17	13	13	9	14
23	8	9	9	8	7	7	5	5	5	5	5	5	5	6	7	7	7	7	7	6	5	5	6	6	6
24	6	6	6	6	6	6	7	7	7	7	7	7	7	7	7	7	7	8	6	6	6	6	6	6	7
25	5	5	5	5	5	6	6	6	5	4	4	4	4	3	3	3	4	3	3	3	2	2	1	1	4
26	0	0	1	1	1	1	0	0	0	0	0	0	1	2	2	2	2	1	1	0	0	0	0	1	0
27	1	1	1	0	0	0	0	0	1	1	2	2	3	4	4	4	4	4	4	4	4	4	4	4	2
28	4	4	4	4	4	4	4	4	4	4	4	5	5	6	6	7	7	7	7	7	6	6	6	6	5
29	5	5	5	4	3	2	2	3	5	5	6	6	6	7	7	7	7	7	7	7	6	6	6	6	5
30	5	5	4	4	3	2	2	4	8	13	15	14	13	12	13	11	11	11	13	12	10	9	8	9	9
HOURLY MEAN	7	7	7	6	6	6	6	7	8	9	10	10	10	10	10	10	11	11	10	10	9	9	9	8	

MAXIMUM= 29.5 MINIMUM= -1.7 MEAN = 8.5
720. VALID OBSERVATIONS (100.0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	5.6	3.9	10.6	5.6	10.0	9.5	8.3	3.9	4.4	14.5	10.6	3.9	10.6	18.9	29.5
MIN	1.7	-0.6	-0.6	0.0	-1.7	4.4	1.7	1.1	-0.6	-0.6	-1.1	-1.1	0.0	5.0	15.6

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	26.7	26.7	26.7	22.2	15.6	23.9	17.8	9.5	7.8	5.6	1.7	4.4	7.2	7.2	15.0
MIN	16.1	17.2	16.1	15.6	10.0	10.6	8.9	5.0	5.6	0.6	-0.6	0.0	3.9	2.2	2.2

MEAN MAXIMUM= 12.3 MEAN MINIMUM= 4.6

Table Q'9

Air Temperature (in Degrees Centigrade) for May 1976

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	10	10	10	10	9	9	10	11	12	14	16	16	13	14	14	13	13	13	13	13	11	11	11	11	12
2	11	11	11	11	10	9	9	10	11	13	16	16	14	18	21	21	21	21	16	11	11	9	8	7	13
3	7	7	6	5	4	4	3	4	4	4	4	4	4	4	5	5	3	4	4	2	2	3	2	2	4
4	4	4	4	4	4	4	4	4	4	5	5	6	7	8	9	9	9	9	10	11	9	9	9	9	7
5	9	9	8	7	7	8	9	10	11	16	19	21	22	24	25	26	27	27	26	26	24	24	24	24	18
6	23	23	22	17	11	11	13	15	13	7	7	9	10	10	7	6	7	7	6	6	5	4	4	4	10
7	4	4	4	4	3	3	3	2	3	3	3	3	4	4	4	4	4	5	6	6	5	5	5	5	4
8	5	5	4	4	4	4	4	5	5	5	5	6	6	7	7	7	8	9	9	9	7	7	6	5	6
9	5	5	5	4	4	4	4	7	10	14	16	16	17	15	15	16	15	16	16	17	16	15	13	12	12
10	11	11	11	11	11	10	10	12	16	19	17	17	17	18	18	18	18	18	21	21	18	19	17	16	16
11	16	16	16	15	14	14	13	13	11	11	11	12	13	11	8	7	7	8	6	5	5	5	5	5	10
12	4	5	5	5	5	5	5	5	5	5	6	7	8	8	9	10	10	11	11	11	10	7	6	5	7
13	4	4	4	4	4	4	4	6	9	13	16	18	19	21	19	15	15	15	15	14	13	12	13	16	12
14	19	18	18	19	19	20	19	18	17	19	21	21	22	19	17	16	19	21	21	21	21	18	14	14	19
15	15	16	16	16	16	16	16	17	18	17	13	14	14	16	16	14	15	15	15	15	15	15	13	13	15
16	13	13	16	21	21	20	20	20	21	22	23	25	24	21	18	16	16	16	18	16	16	16	16	16	18
17	16	16	15	15	15	14	14	14	15	16	16	17	16	16	16	16	16	14	11	9	8	7	7	7	14
18	6	4	4	4	4	4	4	5	5	5	5	6	7	7	8	9	9	9	8	7	7	7	7	7	6
19	7	5	5	5	5	5	5	5	5	5	5	5	7	8	8	9	10	10	11	11	11	11	10	10	7
20	10	10	11	10	10	11	11	11	12	15	16	17	18	18	20	18	19	17	20	21	21	21	16	14	15
21	14	14	14	14	14	12	11	11	14	14	13	13	12	13	13	13	13	13	14	14	13	12	11	10	13
22	10	10	10	9	9	9	9	9	9	9	10	10	10	11	11	12	13	12	11	11	11	10	10	10	10
23	8	6	5	6	5	4	4	6	9	10	10	9	9	10	11	11	12	13	13	11	11	11	10	10	9
24	10	9	9	9	9	9	9	9	9	9	9	10	10	10	11	11	11	11	11	11	10	10	11	11	10
25	10	10	10	10	10	9	9	10	11	11	11	11	11	11	12	12	11	11	11	11	11	11	11	11	11
26	11	11	11	11	11	11	10	10	11	11	11	11	11	12	13	13	14	14	13	13	12	11	11	10	11
27	9	9	9	7	6	6	6	8	13	15	14	14	15	15	15	15	15	16	16	16	16	15	14	14	12
28	14	14	14	13	11	11	12	14	16	19	21	22	23	25	26	26	26	26	25	24	22	21	21	20	19
29	20	19	18	18	17	17	16	16	16	18	21	21	21	21	21	21	21	19	19	19	18	17	16	16	19
30	16	16	16	16	16	15	15	16	18	20	22	19	17	17	16	16	16	17	17	17	16	16	16	17	17
31	17	17	18	17	17	16	16	16	17	18	21	19	19	19	21	20	20	19	19	19	18	17	18	18	18
HOURLY MEAN	11	11	11	10	10	10	10	10	11	12	13	13	14	14	14	14	14	14	14	13	13	12	11	11	

MAXIMUM= 26.7 MINIMUM= 2.2 MEAN = 12.1

744. VALID OBSERVATIONS (100.0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	16.1	21.1	6.7	10.6	26.7	22.8	5.6	9.5	16.7	20.6	16.1	10.5	20.6	22.2	18.3	
MIN	9.5	7.2	2.2	3.9	7.2	4.4	2.2	3.9	3.9	10.0	5.0	4.4	4.4	13.9	12.8	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	25.0	16.7	9.5	10.6	20.6	14.5	12.8	13.3	11.1	11.7	13.9	16.1	26.1	21.1	21.7	20.6
MIN	12.8	7.2	4.4	5.0	10.0	10.0	9.5	3.9	8.9	9.5	10.0	5.6	11.1	16.1	15.0	16.1

MEAN MAXIMUM= 16.4 MEAN MINIMUM= 8.1

Table Q'10

Air Temperature (in Degrees Centigrade) for June 1976

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	17	17	17	16	16	16	16	16	16	15	15	16	15	15	15	14	12	12	11	11	11	11	12	12	14
2	11	11	11	11	11	10	10	10	11	11	12	13	14	15	16	16	16	16	16	15	15	14	14	13	13
3	14	13	12	11	11	10	11	13	16	16	15	15	15	16	16	16	16	16	17	19	18	16	18	16	15
4	16	16	15	15	13	11	11	15	18	18	16	16	17	18	18	18	18	18	18	20	18	16	16	16	16
5	15	15	13	11	11	11	12	15	18	21	21	17	18	19	18	19	20	20	20	19	20	18	18	16	17
6	14	14	13	11	11	12	11	14	15	16	16	16	16	18	20	20	21	21	21	21	20	20	20	19	17
7	18	18	18	18	17	16	16	17	21	21	21	21	21	22	24	26	26	27	26	26	26	22	22	21	21
8	21	21	20	17	17	16	17	21	22	24	24	24	24	25	22	23	24	26	27	26	26	25	23	22	22
9	21	21	20	20	21	21	21	21	22	22	22	22	22	22	22	24	24	24	27	27	26	26	26	24	23
10	22	22	21	21	21	21	21	22	24	27	29	30	27	26	26	27	****	****	****	****	****	****	****	****	24
11	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
13	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
14	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
15	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
16	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
17	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
18	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
19	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
20	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
21	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
22	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
23	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
24	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
25	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
26	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
27	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
28	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
29	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
30	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
HOURLY MEAN	17	17	16	15	15	14	14	16	18	19	19	19	19	20	20	20	20	20	20	20	20	19	19	17	

MAXIMUM= 30,0 MINIMUM= 10,0 MEAN = 18,0
232, VALID OBSERVATIONS (32,24)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	17,2	15,6	18,9	20,0	21,1	21,1	26,7	26,7	26,7	30,0	*****	*****	*****	*****	*****
MIN	10,6	10,0	10,0	10,6	10,6	11,1	16,1	16,1	20,0	20,6	*****	*****	*****	*****	*****

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
MIN	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****

MEAN MAXIMUM= 22,4 MEAN MINIMUM= 13,6

Table Q'11

Air Temperature (in Degrees Centigrade) for July 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
3	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
4	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
5	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
6	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
7	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
8	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	22	22	22	23	22	21	21	22
9	20	19	19	19	18	18	18	18	16	16	19	19	20	20	20	21	21	21	21	22	22	22	22	20	20
10	18	17	16	15	16	16	18	19	20	17	16	16	16	18	21	21	24	27	29	30	30	27	27	26	21
11	26	26	26	26	26	26	26	27	27	27	27	27	27	28	29	27	22	22	21	21	22	22	22	21	25
12	21	21	21	21	21	20	19	18	17	16	16	16	15	15	16	16	17	19	20	21	21	20	20	18	18
13	18	18	17	17	17	16	16	16	16	17	17	17	18	18	20	21	21	21	22	22	22	21	21	21	19
14	19	19	18	17	16	16	14	13	14	16	17	19	21	18	17	19	22	26	27	25	27	27	27	27	20
15	26	26	21	21	21	21	21	21	21	21	23	24	24	24	24	23	23	24	24	24	26	26	26	23	23
16	22	23	23	22	22	21	21	21	21	21	22	22	22	22	22	23	22	22	22	22	18	18	19	20	21
17	20	19	18	17	17	16	16	16	16	16	16	17	18	19	20	21	21	21	21	22	22	22	18	17	19
18	16	16	16	16	16	15	15	15	15	16	19	21	22	23	24	26	25	26	26	27	27	27	26	22	21
19	22	21	21	21	21	20	18	18	19	20	22	25	26	26	26	26	26	26	26	26	27	27	26	24	23
20	22	22	22	21	21	21	20	21	20	21	22	24	26	27	27	28	29	28	27	27	27	27	27	26	24
21	26	26	26	26	25	22	23	21	21	21	21	21	21	21	21	21	21	22	22	22	23	23	22	22	22
22	27	21	21	20	20	19	18	16	16	18	21	22	24	26	27	27	24	24	24	24	24	24	24	24	22
23	23	22	22	22	22	22	21	21	21	22	22	23	23	24	23	22	22	24	26	26	27	27	26	26	23
24	26	24	24	21	21	21	21	22	22	22	22	22	22	22	22	22	23	24	23	23	22	22	21	21	22
25	21	21	21	20	19	19	18	16	14	16	19	19	20	21	21	21	21	21	22	22	21	22	21	18	20
26	16	16	15	15	15	15	15	15	15	16	17	21	24	26	27	27	27	27	27	28	28	27	27	26	21
27	24	23	22	22	22	22	22	21	21	21	21	21	22	22	24	24	24	25	24	24	24	23	23	22	23
28	22	21	21	21	21	21	21	21	21	21	22	24	27	26	26	25	25	24	25	26	26	26	26	25	23
29	24	24	23	24	21	24	23	23	23	22	22	22	22	22	22	23	26	26	26	24	23	22	22	22	23
30	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	22	22	22	22	22	22	22	22	21	21
31	20	19	18	17	16	16	16	16	16	17	19	21	22	22	22	24	24	22	22	22	22	21	21	21	20
HOURLY MEAN	22	21	20	20	20	19	19	19	19	19	20	21	22	22	23	23	23	23	24	24	24	24	23	22	

MAXIMUM= 30.0 MINIMUM= 13.3 MEAN = 21.5
559, VALID OBSERVATIONS (75.1%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	*****	*****	*****	*****	*****	*****	*****	22.8	22.2	30.0	28.9	21.1	21.7	27.2	26.1
MIN	*****	*****	*****	*****	*****	*****	*****	20.6	15.6	16.1	20.6	15.0	16.1	13.3	20.6

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	23.4	22.2	27.2	27.2	28.9	26.1	26.7	26.7	25.6	21.7	28.4	25.0	27.2	25.6	21.7	24.5
MIN	18.3	16.1	15.0	17.8	20.0	20.6	16.1	21.1	20.6	14.5	15.0	20.6	20.6	21.7	20.6	16.1

MEAN MAXIMUM= 25.3 MEAN MINIMUM= 18.0

Table Q'12

Air Temperature (in Degrees Centigrade) for August 1976

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	21	20	20	19	19	19	18	18	18	18	18	18	19	21	21	21	21	21	22	22	22	22	21	21	20
2	16	20	21	21	20	18	15	14	13	15	19	21	21	21	21	21	22	22	22	22	22	21	21	21	19
3	21	21	20	18	15	15	14	13	12	14	18	21	21	21	21	21	22	22	22	22	22	22	21	19	19
4	16	16	16	15	15	15	15	15	15	16	18	21	24	24	23	23	22	23	24	23	23	22	21	21	19
5	19	18	19	20	18	18	18	18	18	18	21	22	24	26	25	27	27	26	27	26	26	25	24	23	22
6	22	21	21	21	21	20	19	18	18	18	17	18	18	18	17	17	18	18	18	19	19	19	20	20	19
7	16	18	18	16	16	15	16	16	16	15	15	16	16	16	16	15	15	16	15	15	15	15	15	15	16
8	16	16	16	16	15	15	15	15	15	15	15	15	15	15	15	16	16	16	16	16	15	16	16	16	15
9	16	16	16	16	16	16	16	16	16	17	16	****	16	17	21	19	19	21	21	21	21	21	20	19	18
10	20	20	20	20	20	20	19	19	18	18	19	21	21	21	21	21	22	21	21	22	22	23	22	21	20
11	18	18	18	18	18	17	17	16	16	17	20	22	24	26	27	27	26	26	27	27	27	26	26	24	22
12	24	24	23	23	23	23	23	22	21	21	21	24	26	26	26	27	29	29	28	29	28	27	26	26	25
13	26	25	26	25	22	21	21	21	21	21	21	21	21	22	22	23	23	23	23	23	23	22	22	21	22
14	19	19	18	18	18	16	16	16	16	16	18	20	21	23	23	22	22	22	22	22	21	21	20	19	20
15	19	19	18	18	19	20	19	19	19	18	18	18	18	18	19	19	21	21	21	21	21	21	21	21	19
16	20	20	20	19	18	18	18	18	17	17	18	19	19	20	21	21	21	21	21	21	21	21	21	21	20
17	21	21	21	20	20	19	13	11	11	14	19	21	21	21	21	22	22	22	22	22	22	22	21	21	19
18	18	18	19	17	16	16	15	15	15	15	19	21	21	22	22	22	22	22	2.	23	23	22	22	21	19
19	19	18	17	16	16	16	16	16	16	17	20	23	25	22	22	23	24	26	26	26	26	26	22	22	21
20	21	20	19	19	19	18	18	18	18	18	21	23	26	27	27	29	26	26	24	24	24	25	22	22	22
21	21	21	20	19	19	18	16	16	16	17	20	22	26	27	26	25	25	25	26	26	26	24	22	21	22
22	21	19	18	17	16	16	16	16	16	16	19	23	25	26	26	26	26	26	25	26	26	26	23	22	22
23	22	21	21	21	21	21	21	20	20	21	21	22	23	24	23	24	24	24	24	24	23	23	23	24	22
24	23	23	22	21	21	21	20	19	17	18	20	22	22	22	22	23	23	24	24	24	23	22	22	21	22
25	21	21	20	19	18	18	18	19	19	19	21	23	26	24	24	24	24	24	24	23	22	22	22	22	22
26	22	22	22	21	21	21	21	21	21	21	22	23	25	24	24	26	26	27	27	27	27	27	25	23	24
27	22	22	22	22	21	21	21	21	21	21	22	23	24	23	27	27	27	28	28	28	28	27	26	25	24
28	24	24	22	22	22	22	22	22	21	22	22	25	27	28	26	26	27	27	27	27	22	22	22	22	24
29	22	22	22	23	23	22	22	20	17	17	17	17	17	17	16	16	16	16	15	16	16	16	16	16	18
30	16	16	15	15	15	15	15	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	15	14	16
31	17	11	11	11	10	9	9	9	9	10	13	16	18	20	22	22	24	25	25	26	25	22	21	21	17
HOURLY MEAN	20	20	19	19	18	18	18	17	17	17	19	20	22	22	22	22	22	23	23	23	22	22	21	21	

MAXIMUM= 28.9 MINIMUM= 9.5 MEAN = 20.3
743. VALID OBSERVATIONS (99.9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	21.7	21.7	21.7	24.5	26.7	21.7	18.3	16.1	20.6	23.4	27.2	28.9	26.1	23.4	21.1	
MIN	17.8	12.8	12.2	15.0	18.3	17.2	15.0	15.0	15.6	18.3	16.1	21.1	20.6	16.1	18.3	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	20.6	21.7	22.8	26.1	28.9	26.7	26.1	24.5	23.9	25.6	27.2	28.4	27.8	22.8	16.1	25.6
MIN	17.2	11.1	15.0	16.1	17.8	16.1	16.1	20.0	16.7	18.3	20.6	20.6	21.1	15.6	13.9	9.5

MEAN MAXIMUM= 23.8 MEAN MINIMUM= 16.6

Table Q'13

Air Temperature (in Degrees Centigrade) for 1 through 14 September 1976

	HOUR																								
DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY MEAN
1	21	20	18	18	18	18	18	18	16	18	21	21	22	22	22	22	22	22	21	18	17	17	17	17	19
2	16	16	16	15	14	13	13	13	15	16	16	16	15	17	17	17	17	18	17	17	17	16	15	12	16
3	12	11	11	11	10	9	9	9	9	10	13	16	18	20	21	22	24	26	26	26	24	23	21	20	17
4	14	17	16	16	16	16	16	16	16	16	17	20	23	24	23	23	22	22	23	23	23	22	22	22	20
5	21	21	20	19	18	18	18	17	17	16	15	16	16	16	16	17	17	17	18	18	18	17	16	15	17
6	16	15	15	15	15	15	15	9	9	9	13	16	15	16	16	16	17	17	17	17	17	17	15	13	15
7	12	11	11	10	10	10	10	10	10	11	13	17	20	21	21	21	21	21	22	22	22	21	21	20	16
8	21	21	18	18	19	18	18	17	16	16	19	22	24	26	27	27	26	27	27	28	28	27	26	24	22
9	22	22	21	21	21	21	20	19	19	17	19	22	26	26	26	26	****	****	****	****	****	****	****	****	22
10	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
11	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
13	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
14	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
HOURLY MEAN	17	17	16	16	16	15	15	14	15	14	16	18	20	21	21	21	21	21	21	21	21	20	19	18	

MAXIMUM= 28.4 MINIMUM= 9.5 MEAN = 18.1
208. VALID OBSERVATIONS (61.9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MAX	22.2	17.8	26.1	23.9	21.1	17.2	21.7	28.4	26.1	*****	*****	*****	*****	*****
MIN	17.2	12.2	9.5	15.6	16.1	9.5	10.0	16.1	16.7	*****	*****	*****	*****	*****

MEAN MAXIMUM= 22.7 MEAN MINIMUM= 13.7

APPENDIX R': SOLAR RADIATION TABLES AND PLOTS

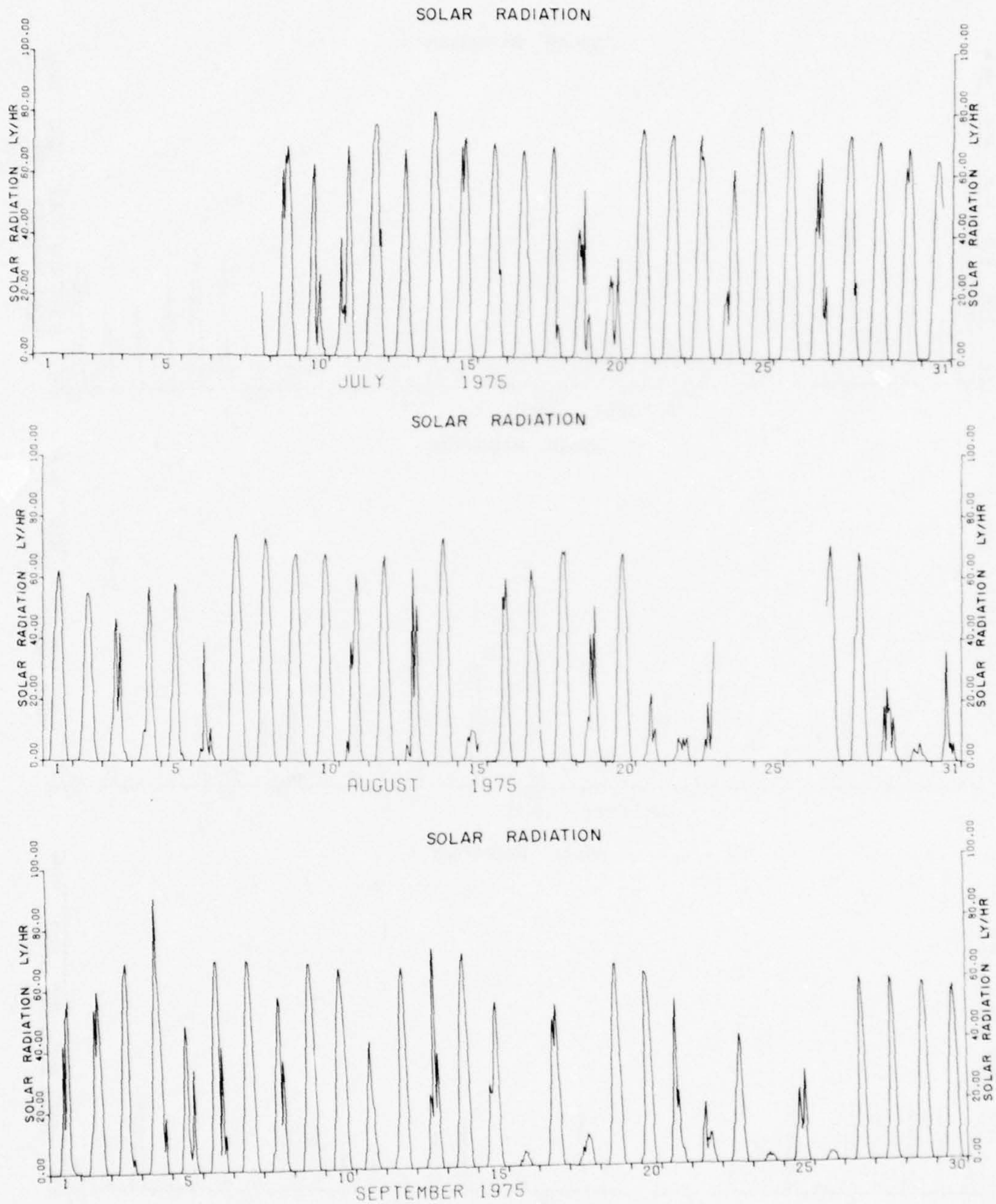


Figure R'1. Solar radiation plots for July, August, and September 1975

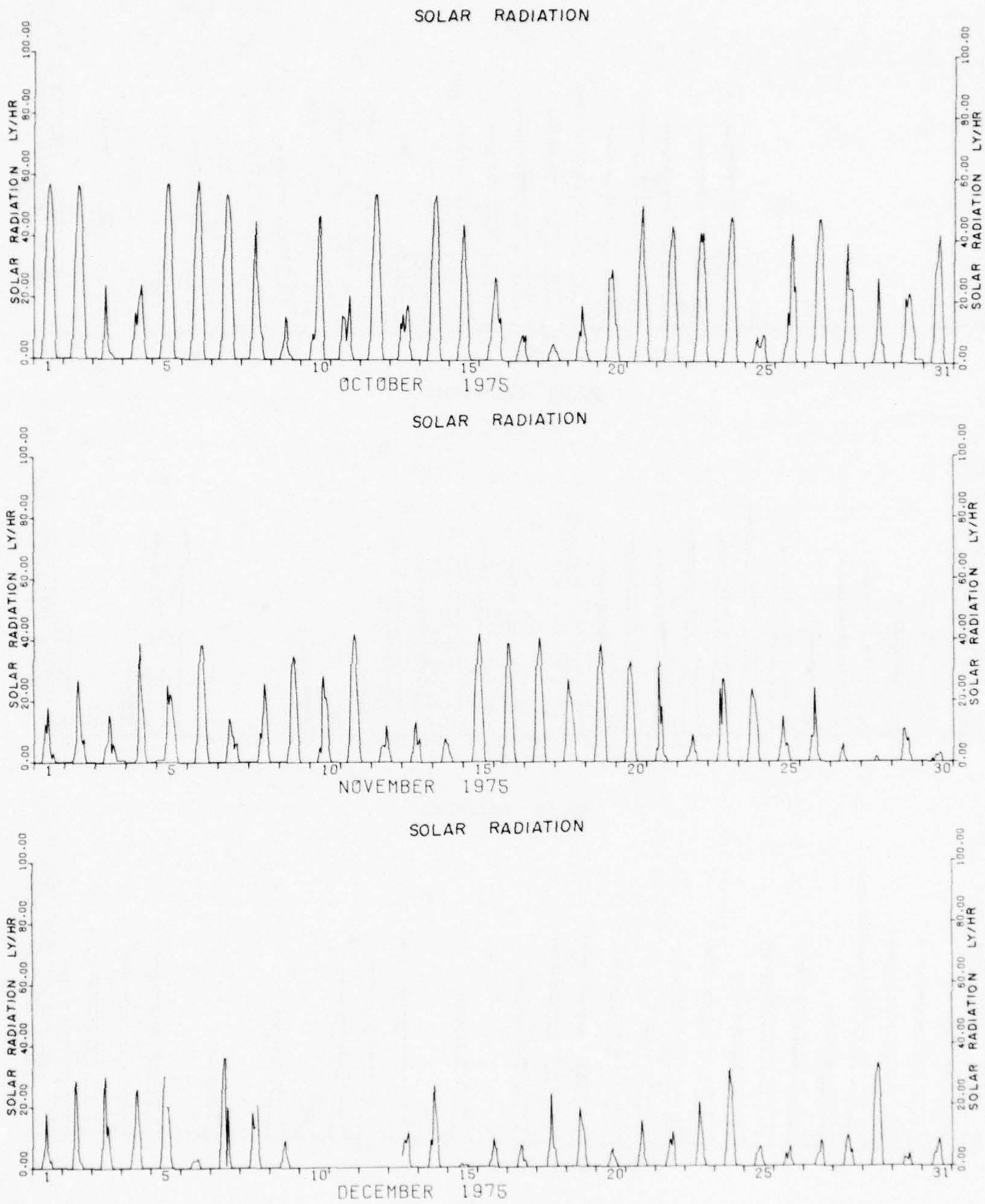


Figure R'2. Solar radiation plots for October, November, and December 1975

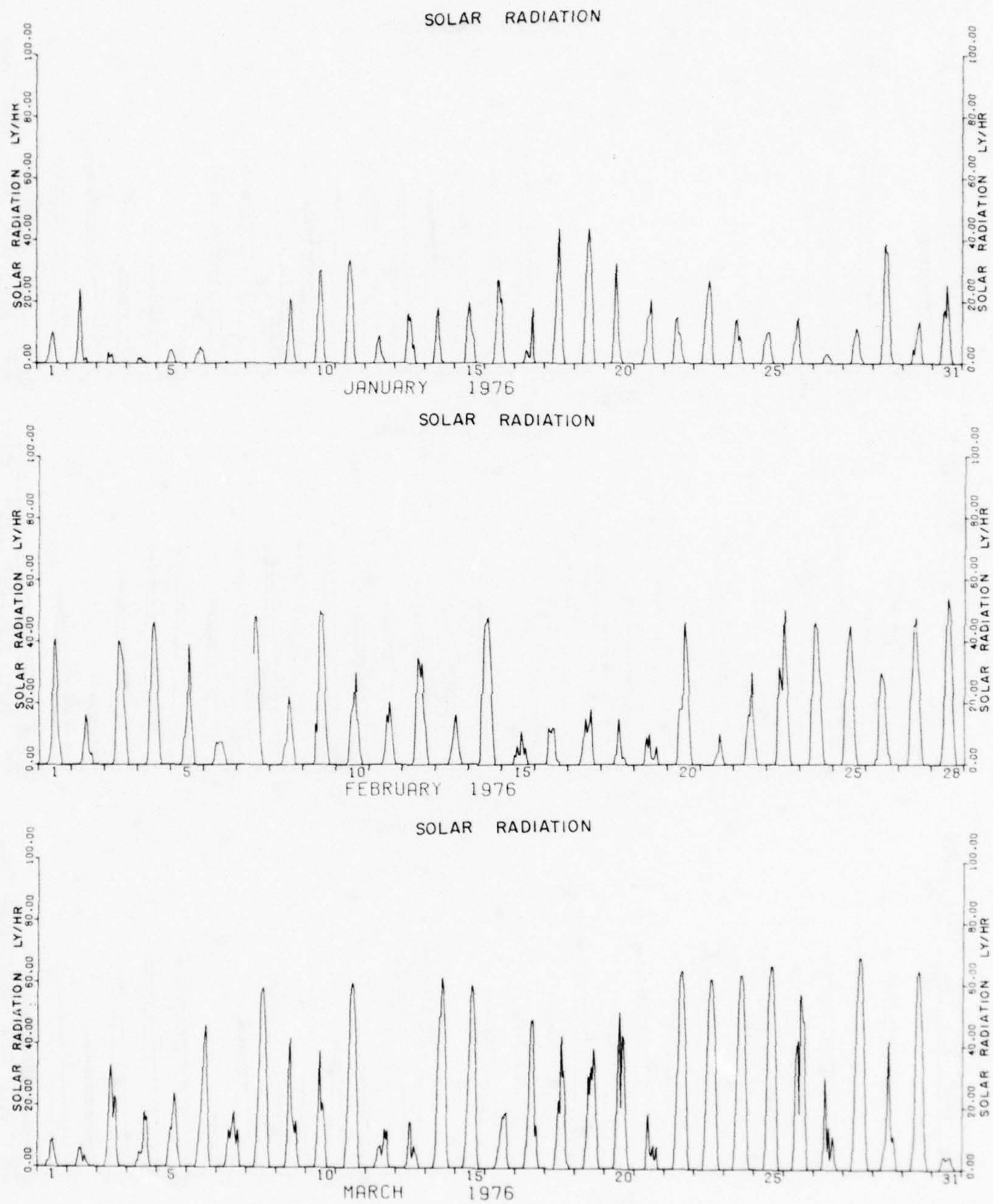


Figure R'3. Solar radiation plots for January, February, and March 1976

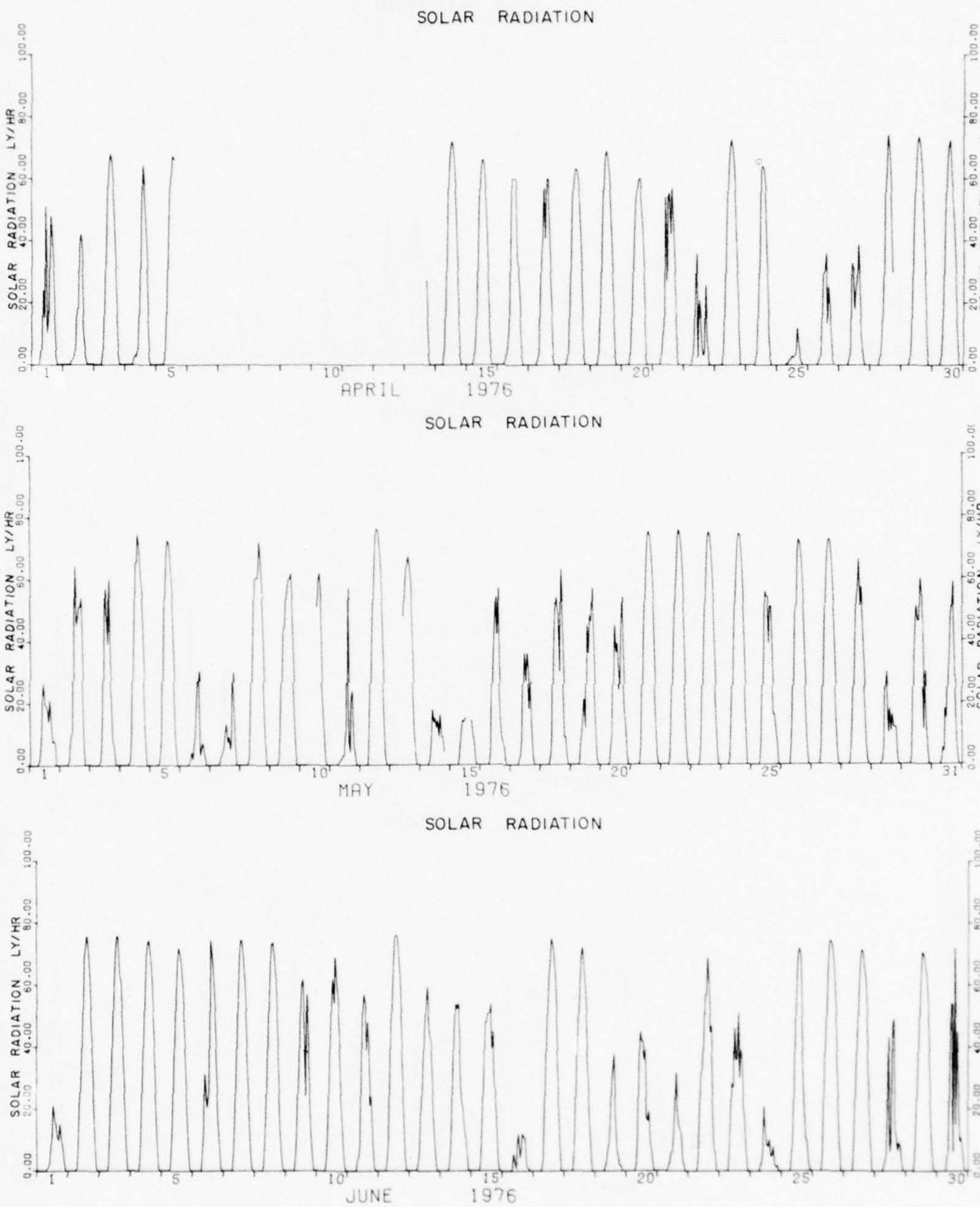


Figure R'4. Solar radiation plots for April, May, and June 1976

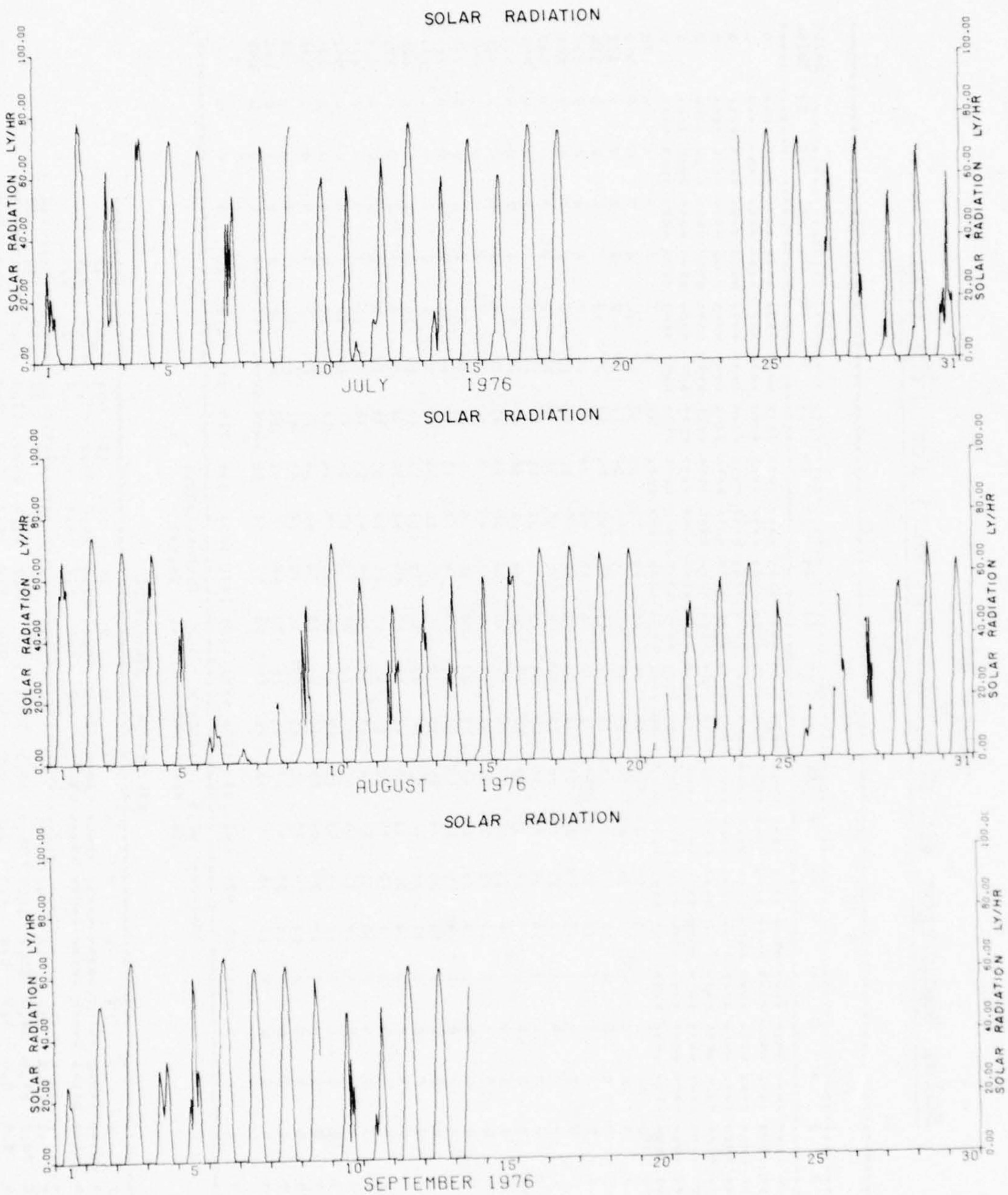


Figure R'5. Solar radiation plots for July, August, and September 1976

Table R'1

Solar Radiation (in Langleys per Hour) for July 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
	HOUR																								
1	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
3	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
4	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
5	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
6	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
7	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
8	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	21	8	1	0	0	0	0	30
9	0	0	0	0	0	0	0	5	19	39	61	45	66	63	69	62	53	43	13	10	2	0	0	0	550
10	0	0	0	0	0	0	1	10	24	43	56	63	54	12	4	15	27	11	8	2	2	0	0	0	333
11	0	0	0	0	0	0	3	4	9	39	15	14	17	11	60	69	58	42	27	15	3	0	0	0	366
12	0	0	0	0	0	0	2	13	27	43	58	71	76	76	75	66	36	42	25	12	2	0	0	0	625
13	0	0	0	0	0	0	1	8	19	25	39	45	59	68	60	49	30	18	10	3	0	0	0	0	434
14	0	0	0	0	0	0	2	11	21	39	66	73	80	60	75	57	54	36	25	12	2	0	0	0	633
15	0	0	0	0	0	0	2	12	27	45	56	69	54	72	70	61	51	33	10	5	1	0	0	0	568
16	0	0	0	0	0	0	1	7	16	39	49	60	67	70	68	62	48	27	29	11	2	0	0	0	557
17	0	0	0	0	0	0	1	10	22	37	49	60	67	68	62	53	33	32	20	9	3	0	0	0	526
18	0	0	0	0	0	0	2	12	25	40	52	61	67	69	65	40	6	11	9	2	0	0	0	0	460
19	0	0	0	0	0	0	1	6	17	39	42	33	37	24	55	4	2	10	14	11	2	0	0	0	298
20	0	0	0	0	0	0	1	6	9	17	18	27	23	25	9	4	13	33	15	12	2	0	0	0	215
21	0	0	0	0	0	0	2	12	25	45	56	65	72	75	73	70	59	42	27	13	2	0	0	0	638
22	0	0	0	0	0	0	1	11	26	40	52	64	71	73	72	68	57	45	30	16	3	0	0	0	628
23	0	0	0	0	0	0	2	12	27	42	55	64	73	65	66	62	53	38	21	9	2	0	0	0	591
24	0	0	0	0	0	0	2	8	18	18	22	11	41	43	51	62	51	38	30	9	2	0	0	0	406
25	0	0	0	0	0	0	3	16	32	47	60	69	75	76	74	64	56	39	25	11	1	0	0	0	645
26	0	0	0	0	0	0	3	14	31	45	60	68	73	75	73	66	55	41	26	11	1	0	0	0	642
27	0	0	0	0	0	0	2	11	25	43	42	62	40	51	66	39	14	13	24	10	2	0	0	0	445
28	0	0	0	0	0	0	2	12	27	43	55	64	71	73	73	55	54	21	25	9	2	0	0	0	596
29	0	0	0	0	0	0	3	15	28	43	56	63	69	71	70	64	52	41	24	12	1	0	0	0	613
30	0	0	0	0	0	0	2	13	27	41	57	63	58	70	68	61	52	37	22	9	1	0	0	0	561
31	0	0	0	0	0	0	2	12	25	40	53	61	65	65	63	54	50	****	****	****	****	0	0	0	490
OURLY TOTAL	0	0	0	0	0	0	44	239	527	893	1130	1274	1373	1375	1421	1218	964	715	469	212	40	0	0	0	

MAXIMUM= 80.4 MINIMUM= 0.0 TOTAL=11892.6
555. VALID OBSERVATIONS (74.64)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	*****	*****	*****	*****	*****	*****	*****	21.0	69.0	63.0	69.0	76.2	67.8	80.4	72.0
MIN	*****	*****	*****	*****	*****	*****	*****	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	70.2	67.8	69.0	55.2	33.0	75.0	73.2	73.2	61.8	76.2	75.0	66.0	73.2	71.4	69.6	64.8
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 66.4 MEAN MINIMUM= 0.0

Table R'2

Solar Radiation (in Langleys per Hour) for August 1975

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	2	10	22	38	47	55	60	62	59	52	40	27	15	6	0	0	0	0	494
2	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
3	0	0	0	0	0	0	1	5	12	14	24	47	42	16	24	42	15	5	3	3	1	0	0	0	254
4	0	0	0	0	0	0	1	2	4	6	10	10	16	42	57	51	42	21	14	9	1	0	0	0	286
5	0	0	0	0	0	0	1	6	18	22	28	58	57	39	31	8	2	2	1	0	0	0	0	0	273
6	0	0	0	0	0	0	1	1	4	3	4	39	16	9	4	2	11	4	2	1	0	0	0	0	101
7	0	0	0	0	0	0	1	10	25	42	57	63	73	74	72	66	54	42	27	13	2	0	0	0	621
8	0	0	0	0	0	0	1	9	24	40	55	65	71	73	70	65	54	41	25	11	1	0	0	0	605
9	0	0	0	0	0	0	2	12	27	42	55	64	66	68	67	61	48	36	20	7	1	0	0	0	577
10	0	0	0	0	0	0	1	4	13	26	47	58	65	68	66	61	49	32	18	6	1	0	0	0	514
11	0	0	0	0	0	0	1	7	2	16	39	30	36	48	61	55	44	22	3	1	0	0	0	0	366
12	0	0	0	0	0	0	1	6	13	24	49	56	63	67	60	49	34	29	16	6	0	0	0	0	474
13	0	0	0	0	0	0	1	5	4	2	1	18	63	21	36	51	33	11	6	2	1	0	0	0	255
14	0	0	0	0	0	0	1	12	24	43	57	67	72	73	63	61	49	38	15	3	0	0	0	0	579
15	0	0	0	0	0	0	1	2	6	8	6	10	10	10	10	8	3	6	****	****	****	****	****	****	60
16	0	0	0	0	0	0	0	0	2	2	4	14	18	54	50	60	51	39	20	6	1	0	0	0	322
17	0	0	0	0	0	0	0	2	10	29	48	57	63	57	57	40	36	33	28	9	6	2	0	0	477
18	0	0	0	0	0	0	0	2	13	30	44	57	66	69	68	69	55	44	22	10	1	0	0	0	550
19	0	0	0	0	0	0	0	2	10	11	15	13	42	33	20	51	27	21	8	4	1	0	0	0	257
20	0	0	0	0	0	0	0	1	5	22	42	56	63	68	68	60	53	45	24	10	2	0	0	0	519
21	0	0	0	0	0	0	0	1	2	2	6	8	18	22	6	9	11	4	2	0	0	0	0	0	91
22	0	0	0	0	0	0	0	1	1	2	3	6	6	6	4	8	5	6	8	2	1	0	0	0	60
23	0	0	0	0	0	0	0	2	4	7	4	19	8	4	17	28	39	****	****	****	****	****	****	****	132
24	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
25	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
26	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
27	****	****	****	****	****	****	****	****	****	****	****	51	60	66	71	64	58	45	32	9	5	0	0	0	461
28	0	0	0	0	0	0	0	1	10	25	40	42	53	68	66	60	51	37	24	11	2	0	0	0	490
29	0	0	0	0	0	0	0	0	3	9	18	3	24	16	17	16	4	14	9	2	2	1	0	0	139
30	0	0	0	0	0	0	0	0	2	3	4	3	3	2	4	6	3	2	2	1	1	0	0	0	36
31	0	0	0	0	0	0	0	0	0	2	5	9	36	18	8	4	6	2	6	2	1	0	0	0	100
HOURLY TOTAL	0	0	0	0	0	0	14	101	260	471	713	980	1170	1154	1136	1108	876	609	350	136	29	2	0	0	

MAXIMUM= 74.4 MINIMUM= 0.0 TOTAL= 9111.6
624. VALID OBSERVATIONS (83.9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	62.4	*****	46.8	57.0	58.2	39.0	74.4	73.2	67.8	67.8	61.2	67.2	63.0	73.2	10.2	
MIN	0.0	*****	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	60.0	63.0	69.0	51.0	68.4	22.2	7.8	39.0	*****	*****	*****	70.8	68.4	24.0	6.0	36.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*****	*****	*****	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 52.1 MEAN MINIMUM= 0.0

Table R'3

Solar Radiation (in Langleys per Hour) for September 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	0	0	0	3	11	15	42	15	51	52	57	5	2	1	1	0	0	0	255
2	0	0	0	0	0	0	0	0	2	10	13	15	36	54	39	60	54	43	27	15	3	0	0	0	371
3	0	0	0	0	0	0	0	2	9	21	36	48	62	66	69	60	10	6	2	5	1	0	0	0	397
4	0	0	0	0	0	0	0	1	5	15	35	52	59	90	66	63	51	39	18	7	18	0	0	0	519
5	0	0	0	0	0	0	0	0	1	8	18	39	49	42	12	8	4	8	34	10	3	1	0	0	236
6	0	0	0	0	0	0	0	1	8	36	54	60	69	69	63	5	41	22	6	12	0	0	0	0	447
7	0	0	0	0	0	0	0	0	3	21	38	50	62	69	68	62	50	36	21	9	2	0	0	0	492
8	0	0	0	0	0	0	0	1	6	6	33	36	48	57	54	15	36	27	12	3	1	0	0	0	334
9	0	0	0	0	0	0	0	0	7	18	30	51	60	68	68	62	54	39	24	9	1	0	0	0	490
10	0	0	0	0	0	0	0	0	9	21	39	54	59	66	63	57	50	38	27	9	1	0	0	0	493
11	0	0	0	0	0	0	0	0	3	8	27	33	42	29	21	20	10	7	3	1	0	0	0	0	205
12	0	0	0	0	0	0	0	0	3	4	14	27	54	63	66	62	48	30	15	3	0	0	0	0	389
13	0	0	0	0	0	0	0	0	1	3	3	24	22	17	72	66	20	38	26	10	4	0	0	0	305
14	0	0	0	0	0	0	0	0	2	14	33	52	59	67	70	63	52	41	24	10	2	0	0	0	469
15	0	0	0	0	0	0	0	0	2	12	27	24	24	33	51	54	48	27	12	4	1	0	0	0	319
16	0	0	0	0	0	0	0	0	0	0	2	1	3	5	4	4	2	2	1	0	0	0	0	0	24
17	0	0	0	0	0	0	0	0	2	15	24	42	48	39	53	46	28	25	9	3	0	0	0	0	334
18	0	0	0	0	0	0	0	0	1	2	3	6	4	8	8	10	9	8	5	2	0	0	0	0	68
19	0	0	0	0	0	0	0	0	5	15	38	52	60	66	66	51	39	27	9	2	0	0	0	0	430
20	0	0	0	0	0	0	0	0	0	2	3	12	63	63	62	57	48	33	18	5	0	0	0	0	365
21	0	0	0	0	0	0	0	0	2	12	24	44	54	18	24	14	7	5	5	2	1	0	0	0	211
22	0	0	0	0	0	0	0	0	1	9	15	20	4	8	7	10	10	5	2	2	0	0	0	0	92
23	0	0	0	0	0	0	0	0	2	8	15	24	27	35	42	39	24	15	8	3	0	0	0	0	242
24	0	0	0	0	0	0	0	0	0	0	1	2	2	3	2	2	2	1	1	0	0	0	0	0	16
25	0	0	0	0	0	0	0	0	0	2	7	10	18	24	14	10	16	30	18	5	1	0	0	0	155
26	0	0	0	0	0	0	0	0	0	0	1	2	2	3	3	3	2	2	1	0	0	0	0	0	19
27	0	0	0	0	0	0	0	0	0	2	6	16	38	60	58	51	41	24	4	1	0	0	0	0	301
28	0	0	0	0	0	0	0	0	0	2	4	17	30	60	58	52	42	22	3	1	0	0	0	0	292
29	0	0	0	0	0	0	0	0	0	4	14	28	40	54	58	58	52	44	27	12	2	0	0	0	394
30	0	0	0	0	0	0	0	0	2	12	26	39	47	54	57	53	45	30	13	2	0	0	0	0	380
HOURLY TOTAL	0	0	0	0	0	0	0	5	76	286	592	896	1187	1304	1350	1170	953	679	376	149	40	1	0	0	

MAXIMUM= 90.0 MINIMUM= 0.0 TOTAL= 9062.4
720. VALID OBSERVATIONS (100.0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	57.0	60.0	69.0	90.0	48.0	69.0	69.0	57.0	67.8	66.0	42.0	66.0	72.0	70.2	54.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	4.8	52.8	10.2	66.0	63.0	54.0	19.8	42.0	3.0	30.0	3.0	60.0	60.0	58.2	57.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 51.4 MEAN MINIMUM= 0.0

Table R'4

Solar Radiation (in Langleys per Hour) for October 1975

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	0	2	14	27	41	52	56	57	53	45	32	14	3	0	0	0	0	0	395
2	0	0	0	0	0	0	0	4	15	28	42	51	56	56	51	41	28	14	2	0	0	0	0	0	389
3	0	0	0	0	0	0	0	0	2	12	24	9	6	3	2	2	1	1	0	0	0	0	0	0	61
4	0	0	0	0	0	0	0	0	3	9	15	11	16	20	21	24	14	8	4	1	0	0	0	0	146
5	0	0	0	0	0	0	0	3	11	24	46	54	57	57	48	41	27	12	2	0	0	0	0	0	382
6	0	0	0	0	0	0	0	2	11	21	39	50	54	58	53	41	30	14	2	0	0	0	0	0	374
7	0	0	0	0	0	0	0	2	9	33	36	51	54	53	48	41	27	14	4	0	0	0	0	0	371
8	0	0	0	0	0	0	0	1	8	21	32	45	27	24	15	9	6	6	2	0	0	0	0	0	198
9	0	0	0	0	0	0	0	0	2	3	4	14	12	4	2	1	1	1	0	0	0	0	0	0	44
10	0	0	0	0	0	0	0	0	3	8	7	9	17	27	46	47	34	21	8	0	0	0	0	0	227
11	0	0	0	0	0	0	0	0	8	14	14	13	6	10	15	21	6	3	1	0	0	0	0	0	112
12	0	0	0	0	0	0	0	2	12	26	39	50	54	54	47	39	24	9	2	0	0	0	0	0	358
13	0	0	0	0	0	0	0	1	12	10	15	9	11	16	18	14	4	3	0	0	0	0	0	0	113
14	0	0	0	0	0	0	0	3	15	27	39	51	52	54	46	36	9	1	0	0	0	0	0	0	334
15	0	0	0	0	0	0	0	1	9	20	35	44	39	30	26	12	2	1	0	0	0	0	0	0	220
16	0	0	0	0	0	0	0	1	4	7	14	18	21	27	26	14	12	14	2	0	0	0	0	0	159
17	0	0	0	0	0	0	0	2	3	5	8	8	6	8	2	1	0	0	0	0	0	0	0	0	44
18	0	0	0	0	0	0	0	0	0	2	3	4	5	5	3	3	2	1	0	0	0	0	0	0	28
19	0	0	0	0	0	0	0	1	6	10	8	18	17	9	7	4	2	1	0	0	0	0	0	0	76
20	0	0	0	0	0	0	0	1	10	27	27	27	30	21	12	12	6	3	0	0	0	0	0	0	176
21	0	0	0	0	0	0	0	2	13	26	37	45	51	33	29	24	11	4	0	0	0	0	0	0	274
22	0	0	0	0	0	0	0	2	12	23	36	38	44	42	36	24	14	4	0	0	0	0	0	0	275
23	0	0	0	0	0	0	0	3	14	27	37	42	39	42	33	28	15	3	0	0	0	0	0	0	283
24	0	0	0	0	0	0	0	3	13	26	39	45	47	46	37	23	10	2	0	0	0	0	0	0	291
25	0	0	0	0	0	0	0	2	5	8	5	5	5	7	9	8	4	1	0	0	0	0	0	0	60
26	0	0	0	0	0	0	0	2	5	7	16	12	23	42	39	23	25	1	0	0	0	0	0	0	194
27	0	0	0	0	0	0	0	5	16	30	40	46	47	43	34	22	9	1	0	0	0	0	0	0	293
28	0	0	0	0	0	0	0	5	12	24	39	24	24	24	24	15	3	1	0	0	0	0	0	0	195
29	0	0	0	0	0	0	0	1	1	5	15	28	16	7	6	6	2	0	0	0	0	0	0	0	87
30	0	0	0	0	0	0	0	5	10	21	18	21	23	21	15	12	9	1	1	1	1	1	1	1	163
31	0	0	0	0	0	0	0	5	16	29	31	34	42	37	29	13	4	1	0	0	0	0	0	0	240
HOURLY TOTAL	0	0	0	0	0	0	0	61	272	562	800	928	953	937	832	644	376	159	34	2	1	1	1	1	

MAXIMUM= 58.2 MINIMUM= 0.0 TOTAL= 6562.8
744. VALID OBSERVATIONS (100.0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	57.0	56.4	24.0	24.0	57.0	58.2	54.0	45.0	13.8	46.8	21.0	54.0	18.0	54.0	44.4
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	27.0	8.4	5.4	18.0	30.0	51.0	44.4	42.0	47.4	9.0	42.0	46.8	39.0	27.6	22.8	42.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 36.5 MEAN MINIMUM= 0.0

Table R'5

Solar Radiation (in Langleys per Hour) for November 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
	HOUR																								
1	0	0	0	0	0	0	0	2	8	13	10	18	8	4	1	3	1	0	0	0	0	0	0	0	67
2	0	0	0	0	0	0	0	1	3	6	21	27	18	8	6	8	2	0	0	0	0	0	0	0	100
3	0	0	0	0	0	0	0	2	5	5	7	16	13	3	6	5	3	1	1	1	1	1	1	1	69
4	0	0	0	0	0	0	0	0	1	2	15	39	27	20	15	4	1	0	0	0	0	0	0	0	122
5	1	1	1	1	1	1	1	4	11	25	19	22	21	16	11	7	2	0	0	0	0	0	0	0	142
6	0	0	0	0	0	0	0	5	10	25	35	38	38	34	24	10	4	0	0	0	0	0	0	0	222
7	0	0	0	0	0	0	0	2	8	14	13	8	6	4	6	6	1	0	0	0	0	0	0	0	71
8	0	0	0	0	0	0	0	0	2	10	8	14	17	26	20	8	2	0	0	0	0	0	0	0	107
9	0	0	0	0	0	0	0	3	5	18	28	35	34	31	21	9	1	0	0	0	0	0	0	0	185
10	0	0	0	0	0	0	0	2	5	3	23	26	21	21	18	5	1	0	0	0	0	0	0	0	128
11	0	0	0	0	0	0	2	9	21	33	39	42	39	27	18	6	1	0	0	0	0	0	0	0	237
12	0	0	0	0	0	0	0	2	5	5	5	5	12	7	4	2	0	0	0	0	0	0	0	0	48
13	0	0	0	0	0	0	0	0	3	3	11	13	5	6	8	1	0	0	0	0	0	0	0	0	50
14	0	0	0	0	0	0	0	0	2	6	8	6	6	4	2	2	0	0	0	0	0	0	0	0	37
15	0	0	0	0	0	0	0	0	4	18	26	33	39	42	35	22	11	1	0	0	0	0	0	0	231
16	0	0	0	0	0	0	0	0	6	18	27	39	39	33	27	15	6	1	0	0	0	0	0	0	211
17	0	0	0	0	0	0	0	0	5	21	33	36	41	36	27	17	6	0	0	0	0	0	0	0	221
18	0	0	0	0	0	0	0	0	5	15	21	27	21	21	15	12	5	0	0	0	0	0	0	0	142
19	0	0	0	0	0	0	0	0	6	18	28	36	38	33	27	18	6	0	0	0	0	0	0	0	211
20	0	0	0	0	0	0	0	0	7	18	30	33	30	27	16	5	1	0	0	0	0	0	0	0	167
21	0	0	0	0	0	0	0	0	4	4	33	12	18	3	2	2	1	0	0	0	0	0	0	0	78
22	0	0	0	0	0	0	0	0	2	2	3	5	9	6	3	3	0	0	0	0	0	0	0	0	33
23	0	0	0	0	0	0	0	0	2	7	24	12	27	27	21	9	1	0	0	0	0	0	0	0	131
24	0	0	0	0	0	0	0	0	4	14	20	24	21	20	15	12	2	0	0	0	0	0	0	0	133
25	0	0	0	0	0	0	0	0	2	6	9	15	7	5	6	4	2	0	0	0	0	0	0	0	56
26	0	0	0	0	0	0	0	0	2	8	8	9	24	11	2	1	1	0	0	0	0	0	0	0	66
27	0	0	0	0	0	0	0	0	2	4	6	2	1	0	0	0	0	0	0	0	0	0	0	0	15
28	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	4
29	0	0	0	0	0	0	0	0	2	10	11	8	7	8	2	2	0	0	0	0	0	0	0	0	49
30	0	0	0	0	0	0	0	0	1	0	1	2	2	2	3	2	0	0	0	0	0	0	0	0	14
OURLY TOTAL	1	1	1	1	1	1	2	34	142	331	522	606	593	485	362	199	61	3	1	1	1	1	1	1	

MAXIMUM= 42,0 MINIMUM= 0,0 TOTAL= 3348,0
720, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	18,0	27,0	15,6	39,0	25,2	38,4	14,4	25,8	34,8	28,2	42,0	12,0	13,2	7,8	42,0
MIN	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	39,0	40,8	27,0	38,4	33,0	33,0	9,0	27,0	24,0	15,0	24,0	6,0	1,8	10,8	3,0
MIN	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

MEAN MAXIMUM= 23,8 MEAN MINIMUM= 0,0

Table R'6

Solar Radiation (in Langleys per Hour) for December 1975

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
	HOUR																								
1	0	0	0	0	0	0	0	0	2	4	7	18	6	4	2	2	0	0	0	0	0	0	0	0	46
2	0	0	0	0	0	0	0	0	0	5	16	29	24	6	2	2	1	0	0	0	0	0	0	0	85
3	0	0	0	0	0	0	0	0	5	9	24	30	10	14	8	5	1	0	0	0	0	0	0	0	106
4	0	0	0	0	0	0	0	0	2	6	11	14	24	26	15	10	1	0	0	0	0	0	0	0	109
5	0	0	0	0	0	0	0	0	4	15	24	30	****	20	20	12	3	0	0	0	0	0	0	0	127
6	0	0	0	0	0	0	0	0	1	2	2	2	2	2	3	1	0	0	0	0	0	0	0	0	16
7	0	0	0	0	0	0	0	0	10	16	30	36	36	1	20	6	2	0	0	0	0	0	0	0	157
8	0	0	0	0	0	0	0	0	2	8	18	13	13	****	20	5	1	0	0	0	0	0	0	0	80
9	0	0	0	0	0	0	0	0	0	2	2	7	9	5	3	2	0	0	0	0	0	0	0	0	30
10	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
11	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
13	****	****	****	****	****	****	****	****	****	****	****	4	8	9	8	10	11	2	0	0	0	0	0	0	51
14	****	****	****	****	****	****	****	****	0	2	9	7	15	27	20	15	7	1	0	0	0	0	0	0	103
15	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	5
16	0	0	0	0	0	0	0	0	0	0	2	2	5	9	6	6	2	0	0	0	0	0	0	0	31
17	0	0	0	0	0	0	0	0	0	3	4	7	7	2	2	2	0	0	0	0	0	0	0	0	27
18	0	0	0	0	0	0	0	0	0	4	8	11	24	6	6	5	2	0	0	0	0	0	0	0	65
19	0	0	0	0	0	0	0	0	0	3	12	19	15	13	11	5	2	0	0	0	0	0	0	0	81
20	0	0	0	0	0	0	0	0	0	0	1	2	4	6	4	3	2	1	0	0	0	0	0	0	22
21	0	0	0	0	0	0	0	0	0	0	2	5	9	15	9	2	2	0	0	0	0	0	0	0	44
22	0	0	0	0	0	0	0	0	0	2	4	7	9	7	11	8	1	0	0	0	0	0	0	0	48
23	0	0	0	0	0	0	0	0	0	2	8	13	21	14	10	3	2	0	0	0	0	0	0	0	72
24	0	0	0	0	0	0	0	0	1	6	13	21	32	27	26	14	6	1	0	0	0	0	0	0	146
25	0	0	0	0	0	0	0	0	0	2	4	5	6	7	4	2	1	0	0	0	0	0	0	0	30
26	0	0	0	0	0	0	0	0	1	2	4	2	4	7	2	1	0	0	0	0	0	0	0	0	22
27	0	0	0	0	0	0	0	0	0	0	2	3	4	4	8	8	3	0	0	0	0	0	0	0	32
28	0	0	0	0	0	0	0	0	0	2	7	9	10	8	4	5	2	0	0	0	0	0	0	0	47
29	0	0	0	0	0	0	0	0	5	17	28	31	34	32	24	8	1	0	0	0	0	0	0	0	180
30	0	0	0	0	0	0	0	0	0	1	3	2	2	2	4	1	0	0	0	0	0	0	0	0	16
31	0	0	0	0	0	0	0	0	1	2	4	4	6	7	9	5	2	0	0	0	0	0	0	0	40
HOURLY TOTAL	0	0	0	0	0	0	0	0	32	114	250	335	340	278	263	149	53	4	0	0	0	0	0	0	

MAXIMUM= 36.0 MINIMUM= 0.0 TOTAL= 1818.6
659. VALID OBSERVATIONS (88.6%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	18.0	28.8	30.0	25.8	30.0	3.0	36.0	20.4	9.0	*****	*****	*****	11.4	27.0	1.2	
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*****	*****	*****	0.0	0.0	0.0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	9.0	7.2	24.0	19.2	6.0	15.0	11.4	21.0	31.8	6.6	6.6	8.4	10.2	33.6	4.2	9.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 16.6 MEAN MINIMUM= 0.0

Table R'7

Solar Radiation (in Langleys per Hour) for January 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
	HOUR																								
1	0	0	0	0	0	0	0	0	1	2	3	6	9	10	8	5	1	0	0	0	0	0	0	0	45
2	0	0	0	0	0	0	0	0	2	5	16	24	14	4	1	1	2	0	0	0	0	0	0	0	68
3	0	0	0	0	0	0	0	0	0	0	4	2	2	3	0	0	0	0	0	0	0	0	0	0	11
4	0	0	0	0	0	0	0	0	0	0	2	1	2	1	1	1	0	0	0	0	0	0	0	0	7
5	0	0	0	0	0	0	0	0	0	1	2	4	4	4	3	2	0	0	0	0	0	0	0	0	19
6	0	0	0	0	0	0	0	0	2	3	3	4	5	4	4	2	0	0	0	0	0	0	0	0	28
7	0	0	0	0	0	0	0	0	0	1	0	0	0	****	****	****	****	****	****	****	****	****	****	****	1
8	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
9	0	0	0	0	0	0	0	0	0	2	6	12	21	19	9	6	2	1	0	0	0	0	0	0	77
10	0	0	0	0	0	0	0	0	1	4	15	20	30	30	18	12	2	0	0	0	0	0	0	0	132
11	0	0	0	0	0	0	0	0	0	6	20	32	34	30	26	14	3	1	0	0	0	0	0	0	165
12	0	0	0	0	0	0	0	0	1	2	5	8	9	4	2	2	1	0	0	0	0	0	0	0	34
13	0	0	0	0	0	0	0	0	0	2	8	16	14	15	10	5	6	1	0	0	0	0	0	0	76
14	0	0	0	0	0	0	0	0	2	7	16	18	8	5	1	1	0	0	0	0	0	0	0	0	56
15	0	0	0	0	0	0	0	0	0	2	12	16	20	15	10	9	7	1	0	0	0	0	0	0	91
16	0	0	0	0	0	0	0	0	2	9	16	27	27	20	21	9	2	0	0	0	0	0	0	0	133
17	0	0	0	0	0	0	0	0	1	2	4	4	2	2	9	18	2	0	0	0	0	0	0	0	43
18	0	0	0	0	0	0	0	0	7	13	24	30	44	30	24	8	3	0	0	0	0	0	0	0	182
19	0	0	0	0	0	0	0	0	6	18	31	38	44	38	31	20	7	0	0	0	0	0	0	0	233
20	0	0	0	0	0	0	0	2	11	22	32	21	7	6	2	1	0	0	0	0	0	0	0	0	104
21	0	0	0	0	0	0	0	1	2	5	7	15	16	16	21	7	2	0	0	0	0	0	0	0	91
22	0	0	0	0	0	0	0	1	2	10	14	15	10	10	7	3	2	0	0	0	0	0	0	0	73
23	0	0	0	0	0	0	0	1	5	11	17	22	24	27	23	9	1	0	0	0	0	0	0	0	141
24	0	0	0	0	0	0	0	1	4	9	14	14	7	9	7	4	1	0	0	0	0	0	0	0	71
25	0	0	0	0	0	0	0	1	2	7	8	10	10	10	6	3	1	0	0	0	0	0	0	0	58
26	0	0	0	0	0	0	0	1	4	7	8	12	15	9	3	1	0	0	0	0	0	0	0	0	59
27	0	0	0	0	0	0	0	0	0	2	2	3	3	2	2	1	0	0	0	0	0	0	0	0	14
28	0	0	0	0	0	0	0	1	4	8	9	11	10	8	4	2	1	0	0	0	0	0	0	0	58
29	0	0	0	0	0	0	0	2	10	24	39	36	36	21	12	3	1	0	0	0	0	0	0	0	184
30	0	0	0	0	0	0	0	0	2	5	3	8	10	12	14	7	2	0	0	0	0	0	0	0	62
31	0	0	0	0	0	0	0	2	8	16	17	15	26	18	11	6	2	0	0	0	0	0	0	0	122
OURLY OTAL	0	0	0	0	0	0	0	10	78	205	358	443	462	382	289	160	50	2	0	0	0	0	0	0	

MAXIMUM= 43.8 MINIMUM= 0.0 TOTAL= 2439.6
709. VALID OBSERVATIONS (95.3%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	10.2	24.0	3.6	1.8	4.2	5.4	0.6	*****	21.0	30.0	33.6	9.0	16.2	18.0	19.8	
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*****	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	27.0	18.0	43.8	43.8	32.4	21.0	15.0	27.0	14.4	10.2	15.0	3.0	11.4	39.0	13.8	25.8
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 18.6 MEAN MINIMUM= 0.0

Table R'8

<u>Solar Radiation (in Langleys per Hour) for February 1976</u>

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	0	2	4	8	24	39	41	27	10	6	2	0	0	0	0	0	0	0	162
2	0	0	0	0	0	0	0	2	7	8	16	13	4	3	4	1	0	0	0	0	0	0	0	0	55
3	0	0	0	0	0	0	0	5	16	30	40	39	36	33	20	14	4	0	0	0	0	0	0	0	236
4	0	0	0	0	0	0	0	4	14	27	38	44	46	41	27	18	2	0	0	0	0	0	0	0	263
5	0	0	0	0	0	0	0	0	2	8	9	13	18	39	24	14	6	0	0	0	0	0	0	0	133
5	0	0	0	0	0	0	0	2	5	7	7	7	7	7	5	3	1	0	0	0	0	0	0	0	51
7	0	0	0	0	0	0	****	****	****	****	****	****	36	48	48	41	24	7	2	0	0	0	0	0	206
8	0	0	0	0	0	0	0	0	0	2	5	7	7	16	22	18	10	6	1	0	0	0	0	0	94
9	0	0	0	0	0	0	0	0	1	13	10	27	50	49	49	40	22	9	3	0	0	0	0	0	272
10	0	0	0	0	0	0	0	0	1	5	11	17	18	20	30	15	14	4	2	0	0	0	0	0	136
11	0	0	0	0	0	0	0	0	0	0	2	4	10	16	13	20	14	7	2	0	0	0	0	0	88
12	0	0	0	0	0	0	0	0	2	9	20	35	33	28	33	24	15	12	3	0	0	0	0	0	214
13	0	0	0	0	0	0	0	0	0	0	2	4	7	10	14	16	9	4	2	0	0	0	0	0	67
14	0	0	0	0	0	0	0	0	2	18	26	38	45	46	48	44	32	18	5	0	0	0	0	0	322
15	0	0	0	0	0	0	0	0	0	3	2	6	3	3	11	7	3	5	2	0	0	0	0	0	46
16	0	0	0	0	0	0	0	0	0	4	12	11	10	12	12	2	1	1	0	0	0	0	0	0	65
17	0	0	0	0	0	0	0	0	0	2	4	8	10	15	10	12	14	18	3	0	0	0	0	0	96
18	0	0	0	0	0	0	0	0	0	0	3	3	9	15	7	2	2	2	0	0	0	0	0	0	43
19	0	0	0	0	0	0	0	1	6	9	5	10	2	2	2	3	6	1	0	0	0	0	0	0	47
20	0	0	0	0	0	0	0	2	13	18	18	18	36	46	39	27	15	4	0	0	0	0	0	0	236
21	0	0	0	0	0	0	0	0	0	0	1	2	4	4	10	6	2	1	0	0	0	0	0	0	31
22	0	0	0	0	0	0	0	0	2	6	12	16	16	30	18	11	5	1	0	0	0	0	0	0	119
23	0	0	0	0	0	0	0	3	18	32	26	24	38	50	33	22	11	2	0	0	0	0	0	0	260
24	0	0	0	0	0	0	0	2	15	26	37	46	45	44	30	26	15	2	0	0	0	0	0	0	287
25	0	0	0	0	0	0	0	2	10	24	33	39	42	45	33	27	8	2	0	0	0	0	0	0	265
26	0	0	0	0	0	0	0	2	2	9	27	30	28	26	21	11	4	3	0	0	0	0	0	0	163
27	0	0	0	0	0	0	0	3	14	26	32	43	48	42	32	26	15	2	0	0	0	0	0	0	283
28	0	0	0	0	0	0	0	2	7	12	33	44	54	51	45	30	16	5	0	0	0	0	0	0	301
29	0	0	0	0	0	0	0	2	8	17	21	14	21	12	1	0	2	0	0	0	0	0	0	0	97
HOURLY TOTAL	0	0	0	0	0	0	0	33	147	325	478	602	723	781	650	487	276	118	24	0	0	0	0	0	

MAXIMUM= 54.0 MINIMUM= 0.0 TOTAL= 4643.4
690, VALID OBSERVATIONS (99.1%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	40.8	16.2	40.2	46.2	39.0	7.2	48.0	22.2	49.8	30.0	20.4	34.8	16.2	48.0	10.8
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29
MAX	12.0	18.0	15.0	10.2	46.2	10.2	30.0	50.4	46.2	45.0	30.0	48.0	54.0	21.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 31.2 MEAN MINIMUM= 0.0

Table R'9

Solar Radiation (in Langleys per Hour) for March 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	0	0	2	2	2	8	9	7	4	2	1	0	0	0	0	0	0	0	37
2	0	0	0	0	0	0	0	0	2	4	6	6	4	1	4	2	1	1	0	0	0	0	0	0	30
3	0	0	0	0	0	0	0	2	4	16	27	33	27	16	23	21	7	2	0	0	0	0	0	0	177
4	0	0	0	0	0	0	0	0	2	7	5	4	4	6	18	15	16	7	2	0	0	0	0	0	80
5	0	0	0	0	0	0	0	0	1	4	8	13	12	18	24	20	15	6	3	0	0	0	0	0	123
6	0	0	0	0	0	0	0	0	2	6	12	15	24	30	42	46	34	20	5	0	0	0	0	0	238
7	0	0	0	0	0	0	0	1	2	7	12	9	12	14	18	11	7	12	6	0	0	0	0	0	111
8	0	0	0	0	0	0	0	2	7	20	30	51	57	58	56	45	33	21	6	0	0	0	0	0	386
9	0	0	0	0	0	0	0	0	2	9	33	42	18	16	14	11	15	6	2	0	0	0	0	0	157
10	0	0	0	0	0	0	0	0	2	12	22	38	18	21	18	15	7	0	0	0	0	0	0	0	154
11	0	0	0	0	0	0	0	0	6	18	30	52	58	60	58	50	37	22	8	0	0	0	0	0	398
12	0	0	0	0	0	0	0	0	2	2	6	7	7	4	6	13	9	12	2	0	0	0	0	0	70
13	0	0	0	0	0	0	0	0	1	1	5	15	15	3	4	7	5	4	2	0	0	0	0	0	62
14	0	0	0	0	0	0	0	2	4	24	42	49	49	62	58	48	33	9	3	0	0	0	0	0	363
15	0	0	0	0	0	0	0	2	7	16	27	39	54	59	58	50	33	11	3	0	0	0	0	0	361
16	0	0	0	0	0	0	0	0	1	2	4	7	11	13	17	16	18	18	3	1	0	0	0	0	110
17	0	0	0	0	0	0	0	0	2	7	13	24	45	48	48	30	10	14	5	1	0	0	0	0	247
18	0	0	0	0	0	0	0	0	2	7	16	22	16	43	30	32	24	6	2	1	0	0	0	0	203
19	0	0	0	0	0	0	0	0	2	7	18	30	24	33	29	39	33	18	14	3	0	0	0	0	250
20	0	0	0	0	0	0	0	0	2	15	21	41	51	20	43	42	30	15	7	2	0	0	0	0	289
21	0	0	0	0	0	0	0	0	0	1	12	18	7	5	4	8	3	3	7	1	0	0	0	0	68
22	0	0	0	0	0	0	0	0	2	15	30	36	60	64	64	59	50	36	20	5	0	0	0	0	442
23	0	0	0	0	0	0	0	0	6	20	36	50	58	62	62	56	48	36	18	6	1	0	0	0	458
24	0	0	0	0	0	0	0	0	3	16	34	48	58	63	63	60	48	33	21	6	1	0	0	0	454
25	0	0	0	0	0	0	0	0	1	5	27	52	62	66	66	62	51	38	22	6	0	0	0	0	457
26	0	0	0	0	0	0	0	1	7	36	34	42	18	57	54	48	48	21	9	0	0	0	0	0	380
27	0	0	0	0	0	0	0	2	8	30	18	6	14	3	5	11	8	2	1	0	0	0	0	0	108
28	0	0	0	0	0	0	0	3	13	33	51	60	69	69	66	56	42	27	10	3	0	0	0	0	503
29	0	0	0	0	0	0	0	2	4	7	10	21	42	24	14	9	11	7	4	0	0	0	0	0	155
30	0	0	0	0	0	0	0	1	6	12	45	63	65	63	54	45	33	15	5	3	0	0	0	0	410
31	0	0	0	0	0	0	0	1	3	4	4	3	4	4	4	4	2	1	1	0	0	0	0	0	35
HOURLY TOTAL	0	0	0	0	0	0	0	17	107	362	646	903	974	1012	1027	934	711	422	190	37	1	0	0	0	

MAXIMUM= 69.0 MINIMUM= 0.0 TOTAL= 7344.0
744. VALID OBSERVATIONS (100.0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	9.0	6.0	33.0	18.0	24.0	46.2	18.0	58.2	42.0	37.8	60.0	12.6	15.0	61.8	59.4	
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	18.0	48.0	43.2	39.0	51.0	18.0	64.2	61.8	63.0	66.0	57.0	30.0	69.0	42.0	64.8	4.2
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 40.0 MEAN MINIMUM= 0.0

Table R'10

Solar Radiation (in Langleys per Hour) for April 1976

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	0	0	6	24	12	48	6	12	30	48	36	30	12	0	0	0	0	0	264
2	0	0	0	0	0	0	0	0	0	0	6	18	18	36	42	36	6	0	0	0	0	0	0	0	162
3	0	0	0	0	0	0	0	0	12	30	42	54	60	66	60	54	42	24	12	0	0	0	0	0	456
4	0	0	0	0	0	0	0	0	0	0	0	12	30	48	60	54	42	30	12	0	0	0	0	0	288
5	0	0	0	0	0	0	0	0	12	30	42	54	60	66	66	****	****	****	****	****	****	****	****	****	330
6	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
7	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
8	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
9	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
10	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
11	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
12	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
13	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	24	12	0	0	0	0	0	36
14	0	0	0	0	0	0	0	6	18	36	54	66	66	72	66	60	48	30	12	0	0	0	0	0	534
15	0	0	0	0	0	0	0	6	18	36	54	60	66	66	60	48	36	18	6	0	0	0	0	0	474
16	0	0	0	0	0	0	0	0	6	12	36	60	60	60	54	30	30	24	6	0	0	0	0	0	378
17	0	0	0	0	0	0	0	0	0	18	36	42	54	36	60	60	42	24	12	0	0	0	0	0	384
18	0	0	0	0	0	0	0	0	18	36	54	60	60	60	60	54	42	24	12	0	0	0	0	0	480
19	0	0	0	0	0	0	0	6	24	42	54	66	66	66	60	54	42	24	12	0	0	0	0	0	516
20	0	0	0	0	0	0	0	6	18	30	42	54	54	60	60	48	42	30	12	0	0	0	0	0	456
21	0	0	0	0	0	0	0	0	6	12	54	24	54	54	42	54	42	30	12	0	0	0	0	0	364
22	0	0	0	0	0	0	0	0	6	18	36	0	18	12	6	0	0	24	6	0	0	0	0	0	126
23	0	0	0	0	0	0	0	6	24	36	54	60	66	72	66	60	48	30	18	6	0	0	0	0	546
24	0	0	0	0	0	0	0	0	0	6	24	36	60	60	60	54	36	24	6	0	0	0	0	0	366
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	6	0	0	0	0	0	0	18
26	0	0	0	0	0	0	0	0	0	0	0	12	30	30	36	12	24	18	6	0	0	0	0	0	168
27	0	0	0	0	0	0	0	0	0	6	30	30	18	24	24	36	24	6	0	0	0	0	0	0	198
28	0	0	0	0	0	0	0	0	0	6	18	30	54	60	72	66	54	30	****	****	****	0	0	0	390
29	0	0	0	0	0	0	0	0	6	24	42	54	66	72	72	66	60	48	36	18	6	0	0	0	570
30	0	0	0	0	0	0	0	0	6	24	42	54	66	66	72	60	48	42	30	12	0	0	0	0	522
HOURLY TOTAL	0	0	0	0	0	0	0	30	180	426	732	894	1032	1098	1128	954	756	540	234	36	6	0	0	0	

MAXIMUM= 72.0 MINIMUM= 0.0 TOTAL= 8046.0
523. VALID OBSERVATIONS (72.6%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	48.0	42.0	66.0	60.0	66.0	*****	*****	*****	*****	*****	*****	*****	24.0	72.0	66.0
MIN	0.0	0.0	0.0	0.0	0.0	*****	*****	*****	*****	*****	*****	*****	0.0	0.0	0.0
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	60.0	60.0	60.0	66.0	60.0	54.0	36.0	72.0	60.0	12.0	36.0	36.0	72.0	72.0	72.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 55.3 MEAN MINIMUM= 0.0

Table R'11

Solar Radiation (in Langleys per Hour) for May 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	0	0	0	6	18	24	18	18	18	12	18	12	6	6	6	0	0	0	162
2	0	0	0	0	0	0	0	0	6	6	6	42	60	42	48	48	48	54	24	0	0	0	0	0	384
3	0	0	0	0	0	0	0	0	0	6	18	42	54	48	36	60	30	18	6	6	0	0	0	0	324
4	0	0	0	0	0	0	0	0	0	6	30	48	60	60	72	66	60	54	42	24	6	0	0	0	528
5	0	0	0	0	0	0	0	0	0	6	30	48	60	66	72	66	60	54	36	24	6	0	0	0	528
6	0	0	0	0	0	0	0	0	0	0	0	6	6	18	24	30	0	0	6	0	0	0	0	0	90
7	0	0	0	0	0	0	0	0	0	0	0	6	6	12	6	6	0	6	30	18	6	0	0	0	96
8	0	0	0	0	0	0	0	0	12	30	48	60	60	60	60	72	60	54	36	18	6	0	0	0	576
9	0	0	0	0	0	0	0	0	12	24	42	42	54	54	60	60	60	48	36	18	6	0	0	0	516
10	0	0	0	0	0	0	0	****	****	****	****	****	****	48	60	60	48	24	18	6	0	0	0	0	264
11	0	0	0	0	0	0	0	0	0	0	0	0	6	12	54	6	0	18	24	6	0	0	0	0	126
12	0	0	0	0	0	0	0	6	24	42	54	60	72	72	72	66	60	48	30	12	0	0	0	0	618
13	0	0	0	0	0	0	****	****	****	****	48	54	60	60	66	60	54	42	30	12	0	0	0	0	486
14	0	0	0	0	0	0	0	0	0	6	18	12	12	12	12	6	12	6	6	0	****	0	0	0	102
15	0	0	0	0	0	0	0	0	6	6	12	12	12	12	****	****	****	12	6	6	0	0	0	0	84
16	0	0	0	0	0	0	0	0	0	18	36	42	54	42	54	30	12	6	6	6	0	0	0	0	306
17	0	0	0	0	0	0	0	0	0	6	24	36	24	36	30	18	24	12	0	0	0	0	0	0	210
18	0	0	0	0	0	0	0	0	0	6	30	48	54	48	48	30	60	48	36	6	6	0	0	0	420
19	0	0	0	0	0	0	0	0	6	6	12	18	12	42	36	48	42	54	42	24	12	0	0	0	354
20	0	0	0	0	0	0	0	0	6	6	24	42	36	36	30	24	42	54	30	18	12	0	0	0	360
21	0	0	0	0	0	0	0	0	6	24	42	54	66	72	72	72	66	54	42	30	12	0	0	0	612
22	0	0	0	0	0	0	0	0	12	24	42	54	60	72	72	72	66	60	42	24	6	0	0	0	606
23	0	0	0	0	0	0	0	0	6	18	36	48	60	72	72	72	66	54	42	30	12	0	0	0	588
24	0	0	0	0	0	0	0	0	12	24	42	54	60	72	72	72	66	54	42	30	12	0	0	0	612
25	0	0	0	0	0	0	0	0	6	18	36	54	54	54	36	48	48	30	12	12	12	6	0	0	426
26	0	0	0	0	0	0	0	0	6	12	30	48	48	66	72	66	66	54	42	30	12	0	0	0	552
27	0	0	0	0	0	0	0	0	6	18	36	48	60	66	72	72	66	54	42	30	12	0	0	0	582
28	0	0	0	0	0	0	0	0	6	12	24	42	54	54	66	48	54	42	30	18	6	0	0	0	456
29	0	0	0	0	0	0	0	0	0	0	6	24	30	18	6	18	6	12	12	12	12	0	0	0	156
30	0	0	0	0	0	0	0	0	0	12	36	42	48	42	42	60	54	42	6	30	12	0	0	0	426
31	0	0	0	0	0	0	0	0	0	0	0	18	12	30	36	48	48	54	24	24	6	0	0	0	300
HOURLY TOTAL	0	0	0	0	0	0	0	6	132	342	780	1128	1272	1416	1476	1416	1296	1134	786	480	180	6	0	0	

MAXIMUM= 72.0 MINIMUM= 0.0 TOTAL=11850.0
730. VALID OBSERVATIONS (98.1%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	24.0	60.0	60.0	72.0	72.0	30.0	30.0	72.0	60.0	60.0	54.0	72.0	66.0	18.0	12.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	54.0	36.0	60.0	54.0	54.0	72.0	72.0	72.0	72.0	54.0	72.0	72.0	66.0	30.0	60.0	54.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 55.4 MEAN MINIMUM= 0.0

Table R'12

Solar Radiation (in Langleys per Hour) for June 1976

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	6	6	18	12	12	6	6	12	6	6	0	0	0	90
2	0	0	0	0	0	0	0	0	6	18	24	36	54	66	72	72	72	60	42	36	18	6	0	0	582
3	0	0	0	0	0	0	0	0	6	18	30	48	60	66	72	72	60	60	48	30	18	6	0	0	594
4	0	0	0	0	0	0	0	0	6	18	30	48	60	66	72	72	66	60	48	36	18	6	0	0	606
5	0	0	0	0	0	0	0	0	6	12	30	42	54	66	72	66	66	54	48	30	18	6	0	0	570
6	0	0	0	0	0	0	0	0	6	12	30	24	18	24	48	72	66	60	48	30	12	6	0	0	456
7	0	0	0	0	0	0	0	0	6	12	24	42	54	66	72	72	66	60	48	30	18	6	0	0	576
8	0	0	0	0	0	0	0	0	6	12	24	42	54	66	72	72	66	60	48	30	12	6	0	0	570
9	0	0	0	0	0	0	0	0	0	12	24	30	48	60	60	42	24	54	42	24	6	0	0	0	426
10	0	0	0	0	0	0	0	0	0	12	24	42	54	60	54	66	60	54	42	24	12	6	0	0	510
11	0	0	0	0	0	0	0	0	0	0	6	30	48	54	54	36	48	36	18	24	6	0	0	0	360
12	0	0	0	0	0	0	0	0	6	24	42	54	66	72	72	72	66	60	48	30	18	0	0	0	630
13	0	0	0	0	0	0	0	0	0	12	18	30	42	48	60	48	42	42	30	18	6	0	0	0	396
14	0	0	0	0	0	0	0	0	6	12	30	42	54	48	54	42	24	18	18	12	6	0	0	0	366
15	0	0	0	0	0	0	0	0	6	18	30	48	48	48	48	54	36	42	24	24	12	0	0	0	438
16	0	0	0	0	0	0	0	0	0	0	0	0	6	12	0	6	12	6	6	0	0	0	0	0	48
17	0	0	0	0	0	0	0	0	0	18	30	48	60	66	72	72	66	60	48	30	18	6	0	0	594
18	0	0	0	0	0	0	0	0	6	18	36	48	60	66	72	66	60	48	36	24	12	6	0	0	558
19	0	0	0	0	0	0	0	0	0	0	6	6	12	24	30	36	18	6	0	0	0	0	0	0	138
20	0	0	0	0	0	0	0	0	0	6	30	42	42	42	36	36	12	12	18	6	6	0	0	0	288
21	0	0	0	0	0	0	0	0	0	0	0	6	6	6	18	30	18	12	12	12	0	0	0	0	120
22	0	0	0	0	0	0	0	0	0	12	30	30	42	54	54	66	60	42	42	24	6	6	0	0	468
23	0	0	0	0	0	0	0	0	6	12	24	24	42	36	36	48	30	36	36	18	12	6	0	0	366
24	0	0	0	0	0	0	0	0	0	0	6	18	12	6	6	6	0	0	6	0	0	0	0	0	60
25	0	0	0	0	0	0	0	0	6	6	24	48	60	66	72	66	42	24	18	6	6	0	0	0	444
26	0	0	0	0	0	0	0	0	6	24	36	48	60	72	72	72	66	60	48	36	18	6	0	0	624
27	0	0	0	0	0	0	0	0	6	18	30	48	60	66	66	66	60	60	48	30	18	6	0	0	582
28	0	0	0	0	0	0	0	0	0	0	12	42	6	6	42	48	12	6	6	6	6	0	0	0	192
29	0	0	0	0	0	0	0	0	12	24	42	54	66	66	66	66	60	54	42	24	6	0	0	0	582
30	0	0	0	0	0	0	0	0	0	6	24	54	54	6	72	12	42	24	6	6	6	0	0	0	312
HOURLY TOTAL	0	0	0	0	0	0	0	0	102	336	696	1080	1308	1422	1608	1566	1326	1176	936	606	300	84	0	0	

MAXIMUM= 72,0 MINIMUM= 0,0 TOTAL=12546,0
720, VALID OBSERVATIONS (100,0%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MAX	18,0	72,0	72,0	72,0	72,0	72,0	72,0	72,0	60,0	66,0	54,0	72,0	60,0	54,0	54,0
MIN	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MAX	12,0	72,0	72,0	36,0	42,0	30,0	66,0	48,0	18,0	72,0	72,0	66,0	48,0	66,0	72,0
MIN	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

MEAN MAXIMUM= 57,8 MEAN MINIMUM= 0,0

Table R'13

Solar Radiation (in Langleys per Hour) for July 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	0	0	0	0	12	30	18	6	18	12	6	12	6	0	0	0	0	0	120
2	0	0	0	0	0	0	0	0	6	12	30	54	78	72	72	60	60	54	42	24	6	0	0	0	570
3	0	0	0	0	0	0	0	6	18	30	48	60	12	12	12	42	54	48	36	12	6	0	0	0	396
4	0	0	0	0	0	0	0	0	12	30	48	60	72	66	72	66	60	48	36	18	6	0	0	0	594
5	0	0	0	0	0	0	0	0	12	30	48	54	60	66	72	66	60	48	36	18	6	0	0	0	576
6	0	0	0	0	0	0	0	6	18	36	48	54	66	66	66	60	54	30	18	6	0	0	0	0	528
7	0	0	0	0	0	0	0	0	6	6	24	42	12	42	24	42	54	42	24	6	0	0	0	0	324
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	66	60	48	36	18	6	0	0	300
9	0	0	0	0	0	0	0	0	6	12	30	42	66	72	72	72	****	****	****	****	****	****	****	****	372
10	****	****	****	****	****	****	****	****	****	****	0	0	24	48	54	54	60	48	30	12	6	0	0	0	336
11	0	0	0	0	0	0	0	0	6	18	24	48	54	48	0	0	0	0	0	6	0	0	0	0	204
12	0	0	0	0	0	0	0	0	12	12	12	12	12	12	48	54	66	54	42	24	6	0	0	0	366
13	0	0	0	0	0	0	0	0	18	30	48	60	60	72	72	72	66	48	36	24	6	0	0	0	612
14	0	0	0	0	0	0	0	0	6	12	12	12	0	6	30	54	60	48	36	18	6	0	0	0	300
15	0	0	0	0	0	0	0	0	6	30	42	48	60	66	72	66	60	48	36	18	6	0	0	0	556
16	0	0	0	0	0	0	0	0	0	6	6	18	48	60	60	54	12	12	6	6	0	0	0	0	288
17	0	0	0	0	0	0	0	0	12	24	42	60	66	72	72	72	60	48	36	18	0	0	0	0	582
18	0	0	0	0	0	0	0	0	18	18	36	60	66	72	72	66	60	48	30	12	0	0	0	0	558
19	0	0	0	0	0	0	0	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
20	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
21	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
22	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
23	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	0
24	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	72	66	54	36	24	12	0	0	0	264
25	0	0	0	0	0	0	0	0	12	24	42	54	66	72	72	66	66	54	24	12	6	0	0	0	570
26	0	0	0	0	0	0	0	0	6	24	36	54	60	66	72	66	60	48	36	18	6	0	0	0	552
27	0	0	0	0	0	0	0	0	0	0	6	6	12	36	30	60	54	42	24	12	0	0	0	0	282
28	0	0	0	0	0	0	0	0	6	18	36	54	60	72	60	42	18	24	12	6	0	0	0	0	408
29	0	0	0	0	0	0	0	0	0	0	0	0	12	6	42	54	36	30	6	0	0	0	0	0	186
30	0	0	0	0	0	0	0	0	0	0	0	6	6	54	66	60	48	42	30	18	6	0	0	0	336
31	0	0	0	0	0	0	0	0	6	12	12	18	6	12	60	18	18	18	18	6	6	0	0	0	210
HOURLY TOTAL	0	0	0	0	0	0	0	12	186	384	642	906	996	1176	1290	1416	1224	1008	684	354	108	6	0	0	

MAXIMUM= 78.0 MINIMUM= 0.0 TOTAL=10392.0
598, VALID OBSERVATIONS (80.4%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	30.0	78.0	60.0	72.0	72.0	66.0	54.0	66.0	72.0	60.0	54.0	66.0	72.0	60.0	72.0	
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	60.0	72.0	72.0	0.0	*****	*****	*****	*****	72.0	72.0	72.0	60.0	72.0	54.0	66.0	60.0
MIN	0.0	0.0	0.0	0.0	*****	*****	*****	*****	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 62.4 MEAN MINIMUM= 0.0

Table R'14

Solar Radiation (in Langleys per Hour) for August 1976

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	0	0	12	30	48	54	54	66	60	54	54	48	36	18	6	0	0	0	540
2	0	0	0	0	0	0	0	0	6	30	48	60	66	72	72	66	60	48	30	12	0	0	0	0	570
3	0	0	0	0	0	0	0	0	12	30	30	54	66	66	66	60	54	42	30	12	0	0	0	0	522
4	0	0	0	0	0	0	0	0	12	30	48	54	54	66	66	60	54	30	18	6	0	0	0	0	498
5	0	0	0	0	0	0	0	0	6	24	36	42	24	48	42	18	12	6	0	0	0	0	0	0	258
6	0	0	0	0	0	0	0	0	0	6	6	6	0	6	12	6	6	6	6	0	0	0	0	0	60
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	****	****	****	****	18	18	0	0	0	0	0	0	36
9	0	0	0	0	0	0	0	0	0	0	0	0	6	42	30	12	48	48	18	18	6	0	0	0	228
10	0	0	0	0	0	0	0	0	0	18	36	48	60	66	66	66	60	48	36	18	6	0	0	0	528
11	0	0	0	0	0	0	0	0	6	18	36	48	60	54	48	24	24	18	12	0	0	0	0	0	348
12	0	0	0	0	0	0	0	0	0	12	30	12	12	42	48	48	24	30	30	12	0	0	0	0	300
13	0	0	0	0	0	0	0	0	0	0	6	12	6	36	36	54	36	42	18	12	0	0	0	0	258
14	0	0	0	0	0	0	0	0	6	12	18	30	24	18	60	48	42	24	6	6	0	0	0	0	294
15	0	0	0	0	0	0	0	0	0	0	0	0	6	24	36	60	54	36	18	12	0	0	0	0	246
16	0	0	0	0	0	0	0	0	12	24	42	48	60	54	54	60	54	42	24	12	0	0	0	0	486
17	0	0	0	0	0	0	0	0	12	30	42	54	60	66	66	60	54	36	24	12	0	0	0	0	516
18	0	0	0	0	0	0	0	0	12	24	42	54	60	66	66	60	54	36	24	6	0	0	0	0	504
19	0	0	0	0	0	0	0	0	18	24	48	54	60	66	60	60	48	36	24	6	0	0	0	0	504
20	0	0	0	0	0	0	0	0	12	30	48	54	66	66	60	54	48	36	18	6	0	0	0	0	498
21	0	0	0	0	0	0	0	0	****	****	****	****	****	****	****	****	****	****	18	6	0	0	0	0	24
22	0	0	0	0	0	0	0	6	12	30	30	48	42	48	48	36	36	30	18	6	0	0	0	0	390
23	0	0	0	0	0	0	0	0	12	6	18	36	54	54	54	48	36	18	6	0	0	0	0	0	342
24	0	0	0	0	0	0	0	6	18	30	42	54	60	60	60	54	42	30	12	0	0	0	0	0	468
25	0	0	0	0	0	0	0	0	6	18	30	36	48	42	42	36	24	12	0	0	0	0	0	0	294
26	0	0	0	0	0	0	0	0	6	6	6	6	6	12	12	****	****	****	12	****	****	0	0	0	66
27	0	0	0	0	0	0	0	0	12	18	18	****	48	48	42	24	30	18	6	0	0	0	0	0	264
28	0	0	0	0	0	0	0	****	****	****	42	42	18	42	12	30	0	0	0	0	0	0	0	0	186
29	0	0	0	0	0	0	0	0	6	30	30	48	54	54	54	42	30	18	0	0	0	0	0	0	366
30	0	0	0	0	0	0	0	6	18	30	36	48	60	66	60	54	30	24	12	0	0	0	0	0	444
31	0	0	0	0	0	0	0	6	24	42	48	60	60	54	48	42	36	24	6	0	0	0	0	0	450
HOURLY TOTAL	0	0	0	0	0	0	0	24	240	552	864	1062	1194	1404	1380	1236	1068	804	462	180	18	0	0	0	

MAXIMUM= 72.0 MINIMUM= 0.0 TOTAL=10488.0

721, VALID OBSERVATIONS (96.9%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MAX	66.0	72.0	66.0	66.0	48.0	12.0	0.0	18.0	48.0	66.0	60.0	48.0	54.0	60.0	60.0	
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
MAX	60.0	66.0	66.0	66.0	66.0	18.0	48.0	54.0	60.0	48.0	12.0	48.0	42.0	54.0	66.0	60.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 50.9 MEAN MINIMUM= 0.0

Table R'15

Solar Radiation (in Langleys per Hour) for 1 through 14 September 1976

DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
1	0	0	0	0	0	0	0	6	6	12	24	24	18	18	12	6	0	0	0	0	0	0	0	0	126
2	0	0	0	0	0	0	0	0	6	18	42	48	48	48	48	42	36	18	6	0	0	0	0	0	360
3	0	0	0	0	0	0	0	0	12	24	42	54	60	60	60	54	48	30	12	6	0	0	0	0	462
4	0	0	0	0	0	0	0	0	6	18	30	24	18	12	18	24	30	24	12	0	0	0	0	0	216
5	0	0	0	0	0	0	0	0	6	12	18	6	42	60	54	18	30	24	12	0	0	0	0	0	282
6	0	0	0	0	0	0	0	0	18	30	48	54	60	66	60	54	42	30	12	0	0	0	0	0	474
7	0	0	0	0	0	0	0	0	12	30	42	54	60	60	60	48	36	24	12	0	0	0	0	0	438
8	0	0	0	0	0	0	0	0	12	30	42	54	60	60	60	48	42	24	6	0	0	0	0	0	438
9	0	0	0	0	0	0	0	0	12	30	42	48	54	48	48	30	****	****	****	****	****	****	****	****	312
10	0	0	0	0	0	0	0	0	6	12	24	36	48	48	6	30	12	24	0	0	0	0	0	0	246
11	0	0	0	0	0	0	0	0	0	6	12	6	12	24	30	48	36	18	6	0	0	0	0	0	198
12	0	0	0	0	0	0	0	6	18	36	48	54	60	60	54	48	36	18	6	0	0	0	0	0	444
13	0	0	0	0	0	0	0	6	18	36	48	54	60	60	54	42	30	18	0	0	0	0	0	0	426
14	0	0	0	0	0	0	0	6	18	30	36	48	54	****	****	****	****	****	****	****	****	****	****	****	192
HOURLY TOTAL	0	0	0	0	0	0	0	24	150	324	498	564	654	624	564	492	378	252	84	6	0	0	0	0	

MAXIMUM= 66.0 MINIMUM= 0.0 TOTAL= 4614.0
317. VALID OBSERVATIONS (94.3%)

DAILY EXTREME STATISTICS

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MAX	24.0	48.0	60.0	30.0	60.0	66.0	60.0	60.0	54.0	48.0	48.0	60.0	60.0	54.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MEAN MAXIMUM= 52.3 MEAN MINIMUM= 0.0

APPENDIX S': HYDROLOGY: LAKE LEVEL, ASHTABULA RIVER DISCHARGE, AND PRECIPITATION TABLES AND PLOTS

Table S'1

Mean Hourly Lake Elevation of Lake Erie at Fairport, Ohio, during the Large-Scale and Detailed Bathymetric Surveys

Date	Time	Transect No.	Type of Survey	Lake Elevation (ft)
25 June 1975	0700	1	Large Scale	572.85
	0800	2		572.87
	0900	3		572.87
	1000	4		572.92
	1100	5		572.94
	1200	5		572.88
26 June	1800	6		572.83
	1900	7,8		572.86
	2000	9		572.85
	2100	10		572.81
27 June	0700	11		572.78
	0800	12,13		572.89
	0900	14		572.89
	1000	15		572.84
	1100	16		572.89
	1200	16		572.82
8 July	1600	17		572.63
	1700	18		572.64
	1800	20		572.67
	1900	21,22		572.71
10 July	1500	E-W 1,2	Detailed	572.84
11 July	1100	3		572.84
	1700	4,5		572.64
	1800	6-10		572.47
	1900	11-17		572.62
	2000	17		572.60
	2000	7		572.60
	2100	1-6		572.60
9 Sept. 1976	1900	10	Large Scale	572.29
13 Sept.	0700-0900	9		572.09
	1200-1900	1-8,11-16		572.15

Table S'2

Mean Hourly Lake Elevation of Lake Erie at Fairport, Ohio, during the Monthly Bathymetric Surveys from 2 August 1975 to 9 July 1976

Date	Time	Transect No.	Location	Type of Survey	Lake Elevation (ft)
2 August 1975	1000	1-3	TC4	Detailed	572.43
	1100	4-7			572.42
	0800	1-2	TC5		572.46
	0900	3-4			572.47
	1000	5-7			572.43
4 August	1200	1		Control	572.58
	1300				572.43
	1400	2			572.74
	1500	3,4			572.35
	1600	4			572.47
8 August	1400	1-7	TC4	Detailed	572.40
	1800		TC5		572.38
	1900				572.35
14 August	1900	1-3	TC4		572.28
	2000	4-7			572.28
	1500	1-7	TC5		572.28
	1700			Detailed N-S	572.28
	1800				572.28
15 August	0900	1-3	TC4	Detailed N-S,E-W	572.39
	1000	4-7			572.25
	1000	1-7	TC5		572.27
15 September	1900	1-3	TC4	Detailed	572.40
	2000	4-7			572.54
	1700		TC5		572.45
	1900				572.40
	2300	1		Control	572.46
	2200	2			572.45
	2300				572.46
	2100	3			572.51
	2200				572.45
	2000	4			572.40
	2100				572.51
12 November	1100	1-3	TC5	Detailed	571.79
	1200	4-7			571.81
16 November	1900	1-3	TC4		571.67
	2000	4-7			571.69
	2000	1-2		Control	571.69
	2100	3-4			571.71
26 March 1976	1100	1-3	TC4	Detailed	572.79
	1200	4-7			572.76
	1000		TC5		572.88
	1100				572.79
20 April	0600	1-3	TC4		572.73
	0700	4-7			572.91
	0700	1,2	TC5		572.91
	0800	3			572.84
	1000	4-7			572.80
13 May	0700	1-7	TC5		572.86
14 May	1800		ND		572.97
	1900				572.95
	2000		TC4		572.94
27 May	1000			N-S & radial	572.91
	1100			E-W	572.92
	1200				572.88
8 June	0700	1-12	ND	Detailed N-S	572.86
	0800				572.87
	0900				572.81
	1000	1-3		E-W	573.12
	1300	1-7		Detailed	572.78
	1300	1-7	TC4		572.78
	1400	1-7	TC5		572.74
8 July	1700	1-7	TC4		572.78
	1800	1-7	TC5		572.98
9 July	1900	1-7	ND		572.92
	2000			N-S	572.97
	2100			E-W	572.97
9 Sept.	1800	1-20	ND	N-S, E-W	572.23

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AQUATIC DISPOSAL FIELD INVESTIGATIONS ASHTABULA RIVER DISPOSAL --ETC(U)
DEC 77 L J DANEK, G R ALTHER, P P PAILY DACW39-75-C-0108
UNCLASSIFIED WES-TR-D-77-42-APP-B NL

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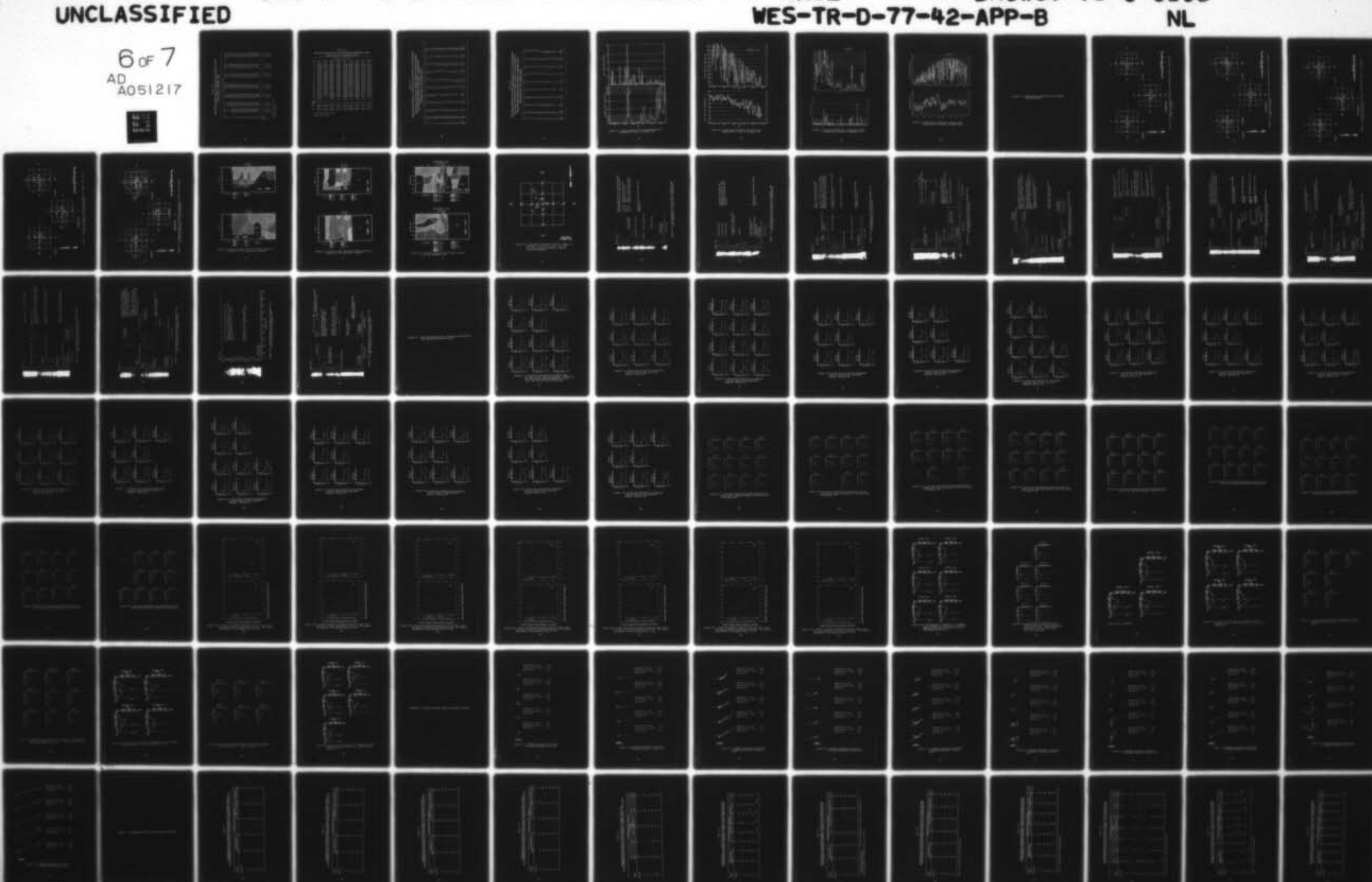
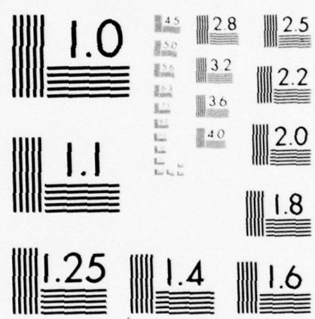




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table S'3

Mean Daily Water Level of Lake Erie at Fairport, Ohio,

during June - December 1975

Water Level is in Feet

Day	June	July	August	September	October	November	December
1	**	572.76	572.45	572.69*	572.35	**	571.46
2	**	572.74	572.46	572.70*	572.40	571.86*	571.59
3	**	572.76	572.49	572.66*	572.12	571.85	571.62
4	**	572.82	572.52	572.67*	572.15	571.86	571.59
5	572.71*	572.76*	572.54	572.65*	572.16	571.89	571.52
6	572.79*	572.75	572.65	572.65*	572.14	571.88	571.75
7	572.84	572.75	572.44	572.61*	572.18	511.87	571.71
8	572.79	572.73	572.40	572.57*	572.20	571.86	571.70
9	572.76	572.74*	572.36	572.56	572.23	571.88	571.69
10	572.72	572.72	572.38	572.50	572.17	571.69	571.68
11	572.73	572.70	572.37	572.46	572.20	571.85	571.59
12	572.72	572.66	572.41	572.68*	572.13	571.89	571.77
13	572.73	572.67	572.41	572.51	572.13	572.01	571.73
14	572.79	572.68	572.39*	572.47	572.08	572.06	571.58
15	572.80	572.63	572.32	572.41	572.09	571.66	571.73
16	572.75	572.63	572.37*	572.41	572.10	571.72	571.82
17	572.76	572.60	572.35*	572.44	572.26	571.70	571.78
18	572.73*	572.58	572.37*	572.46	572.37	571.71	571.96
19	572.78*	572.53	572.34*	572.49	572.18	571.71	571.66
20	572.87*	572.59	572.30*	572.52	572.06	571.71	571.84
21	572.85	572.62	572.24	572.39	571.99	571.70	571.93
22	572.80	572.60*	572.30	572.42	572.10	571.76	571.80
23	572.80	572.57*	572.39*	572.43	572.07	571.69	571.89
24	572.82	572.57	572.39	572.59	572.07	571.70	571.76
25	572.87	572.56	572.40*	572.55	572.07	571.71	571.74
26	572.84	572.53	572.51*	572.42	572.08	571.76	571.89
27	572.81	572.50	572.47	572.41	572.04	571.55	571.84
28	572.82	572.48	572.45	572.39	572.00	571.63	571.81
29	572.81	572.45	572.42	572.36	572.11*	571.59	571.80
30	572.79	572.43	572.64*	572.28	**	571.60	571.78
31	-	572.40	572.63*	-	571.96*	-	571.91
Monthly Mean	572.79*	572.63	572.42*	572.51*	572.14*	571.77	571.74
Max.	573.53 1725/15	573.31 1750/10	573.09 1320/13	573.16 0155/12	572.84 2135/17	572.91 1105/10	572.35 0231/21
Min.	572.29 2207/15	572.11 1830/19	571.73 0053/22	571.96 0630/30	571.67 1600/28	570.02 1600/10	570.85 0140/01

* Mean based on Partial Record

** Record not available

Table S'4

Mean Daily Water Level of Lake Erie at Fairport, Ohio, during January - September 1976

Water Level is in Feet

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.
1	571.89	571.72	572.42	572.95	572.94	572.95	572.97	572.89	572.39
2	571.84*	571.50	572.67	572.98	572.94	572.89	572.91	572.84*	572.44
3	571.82	571.51	572.67	572.96	572.94	572.89	572.92	572.79*	572.34
4	571.88	571.50	572.64*	573.07	572.88	572.88	572.88	572.75	572.26
5	571.75*	**	572.65	572.91	572.77	572.89	572.82	572.71	572.34
6	571.53*	571.51*	572.71	572.92	572.94	572.86	572.82	572.79	572.25
7	571.74	571.44	572.75	572.93	573.03	572.88	572.85	572.89	572.20
8	571.78	571.44	572.79	572.97	572.92	572.85	572.88	572.76	572.20
9	571.53	571.44	572.81	572.93	572.90	572.83	572.88	572.73	572.29
10	571.63	571.40	572.78	572.86	572.93	572.84	572.84	572.66	572.28
11	571.69	571.43	572.82	573.03	572.97	572.81	572.93	572.67*	572.25
12	571.68	571.38	572.80	572.87	572.92	572.85	573.00	572.64	572.13
13	571.83	571.45	572.82	572.82	572.91	572.78	572.92	572.69*	572.13
14	571.68	571.45	572.76	572.84	572.94	572.76	572.92	572.75	572.14
15	571.68	571.42	572.84	572.82	572.95	572.76	572.92	572.73	572.15
16	571.77	571.57	572.93	572.82	572.96	572.80	572.88	572.68	572.18
17	571.82	571.65	572.89	572.85	572.99	572.80	572.91	572.67	572.29
18	571.75*	571.79	572.77	572.82	573.07	572.81	572.82	572.66	572.26
19	**	571.72	572.76	572.80	572.98	572.79	572.80	572.66	572.20
20	571.65*	571.92	572.75	572.82	572.92	572.85	572.78	572.63	572.23
21	571.68	572.00	572.81	572.84	572.94	572.85	572.88	572.58*	572.31
22	571.66	572.21	572.84	572.82	572.96	572.77	572.88	572.59	572.16
23	571.69	572.18	572.81	572.81	572.96	572.76	572.86	572.61	572.08
24	571.68	572.14	572.77	572.86	572.95	572.76	572.89*	572.60	572.09
25	571.63	572.18	572.70	573.16	572.93	572.79	572.86	572.57	572.04
26	571.68	572.22	572.83	573.08	572.91	572.81	572.79	572.56	572.07
27	571.57	572.23	572.79	572.94	572.89	572.81	572.78	572.53	572.20
28	571.58	572.21	572.89	572.93	572.91	572.90	572.84	572.53	572.12
29	571.66	572.27	572.92	572.92	572.89	572.85	572.84	572.57	571.99
30	571.67	-	572.93	572.93	572.90	572.95	572.91	572.48	572.08*
31	571.63	-	572.90	-	572.90	-	572.91	572.40	-
Monthly Mean	571.70*	571.75*	572.79*	572.91	572.93	572.83	572.87*	572.66*	572.20*
Max.	572.63 2000/13	572.58 2050/29	573.53 1817/27	573.79 1730/25	573.57 0358/07	573.83 1010/28	573.53 0555/12	573.13 1645/07	573.41 2055/09
Min.	571.23 0330/14	571.08 0915/17	571.88 1229/02	572.30 1357/21	572.37 0035/03	572.28 1725/28	572.20 9828/10	572.20 0540/18	571.51 1210/23

* Mean based on Partial Records

** Record not available

Table S'5

Mean Daily Discharge (in cubic feet per second) of the Ashtabula River from a Stream Gage (USGS) located 5.5 miles Upstream from Ashtabula Harbor during March - December 1975

(Drainage Area = 121 square miles)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	175	152	37	29	5.5	.60	440	12.0	11	389
2	146	129	32	188	3.8	.60	248	10.0	13	212
3	114	152	27	123	2.7	.70	118	8.7	17	101
4	100	242	42	139	2.4	1.2	65	7.6	23	66
5	90	175	57	1500	1.8	5.0	40	6.2	33	51
6	108	126	66	1430	1.7	10	28	5.6	30	225
7	316	111	66	453	1.5	10	22	4.9	26	684
8	1260	123	61	170	1.4	5.0	21	4.6	22	222
9	420	111	42	97	1.4	3.0	14	54.0	23	124
10	255	89	29	61	1.4	1.8	10	122.0	33	320
11	179	72	22	43	1.8	1.4	8.4	77.0	196	304
12	184	59	17	68	1.5	1.2	8.9	46.0	131	188
13	740	49	16	260	1.3	1.0	7.4	29.0	66	251
14	440	40	13	132	3.3	.95	6.4	20.0	57	802
15	179	35	14	70	2.7	1.4	5.0	16.0	70	898
16	152	34	12	68	1.9	1.6	6.4	17.0	61	1210
17	188	34	11	120	1.5	1.7	6.9	32.0	51	389
18	545	38	9.9	68	1.4	1.6	13	154.0	40	171
19	1570	251	8.7	38	1.4	1.5	55	227.0	31	110
20	1470	275	8.1	24	1.5	1.3	71	129.0	26	155
21	472	156	8.7	16	1.4	2.7	91	94.0	25	141
22	255	99	11	12	1.3	12	63	67.0	29	134
23	224	70	9.2	49	1.1	12	36	47.0	35	165
24	305	72	12	20	.99	10	32	34.0	31	149
25	850	132	16	11	1.3	8.1	48	27.0	26	153
26	414	117	20	7.6	1.2	93	50	21.0	23	200
27	224	79	18	123	.99	407	35	18.0	25	446
28	146	57	53	53	.99	118	28	15.0	44	414
29	170	45	43	21	.80	65	23	13.0	55	249
30	338	42	23	9.9	.70	812	15	12.0	226	437
31	215	-	16	-	.60	752	-	11.0	-	1580
Total	12244	3166	820.6	5403.5	53.27	2343.35	1615.4	1341.6	1479.0	10940.0
Mean	395	106	26.5	180	1.72	75.6	53.8	43.3	49.3	352.9
Max	1570	275	66	1500	5.5	812	440	227.0	226.0	1580.0
Min	90	34	8.1	7.6	.60	.60	5.0	4.6	11.0	51.0

Table S'6

Mean Daily Discharge (in cubic feet per second) of the Ashtabula River from a Stream Gage (USGS) located 5.5 miles Upstream from Ashtabula Harbor during January - September 1976

(Drainage Area = 121 square miles)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	718	194	586	971	35	10	127	15	3.9
2	257	129	418	539	30	12	84	13	3.5
3	704	160	581	277	34	8.8	47	12	3.5
4	393	151	1460	136	67	12	29	11	4
5	156	109	1550	86	77	10	20	9.1	3.9
6	134	111	607	63	66	7.8	16	9.3	3.3
7	129	108	239	51	101	6.2	13	16	5.7
8	194	111	146	45	131	5.3	14	111	5.1
9	398	112	106	37	91	5.2	20	111	3.5
10	346	125	77	31	62	4.8	21	59	8.7
11	282	459	98	30	47	4.1	34	34	7.9
12	263	849	101	29	39	3.5	77	24	6.8
13	361	922	218	28	35	3.7	69	21	12
14	1250	942	179	26	30	3.3	44	20	15
15	1810	627	143	23	27	2.7	28	98	12
16	1620	1510	101	21	25	4.1	20	86	11
17	1090	3810	83	20	26	4.5	15	49	17
18	682	1680	81	18	167	3.3	11	29	294
19	459	1780	267	16	182	8.8	9.1	19	247
20	444	838	540	14	95	8.8	8.8	12	108
21	327	718	277	15	60	15	412	8.9	136
22	283	1980	308	21	42	12	591	7.1	196
23	278	849	132	55	31	10	213	6.5	192
24	389	358	84	67	24	11	423	4.1	101
25	358	289	65	62	20	15	150	3.6	73
26	1300	230	58	195	17	19	72	3.4	59
27	1920	172	54	159	15	19	44	3.4	323
28	988	147	93	94	13	18	29	20	311
29	495	152	104	63	11	16	23	17	146
30	297	-	71	46	11	45	20	5.8	87
31	219	-	119	-	11	-	17	3.9	
Total	18544.0	19622.0	8946.0	2638.0	1622.0	309.9	2700.9	842.1	2399.8
Mean	598.2	676.6	288.6	87.9	52.3	10.3	87.1	27.2	80.0
Max	1920.0	3810.0	1550.0	971.0	131.0	45.0	591.0	111	323
Min	129.0	108.0	54.0	14.0	11.0	2.7	9.1	3.4	3.3

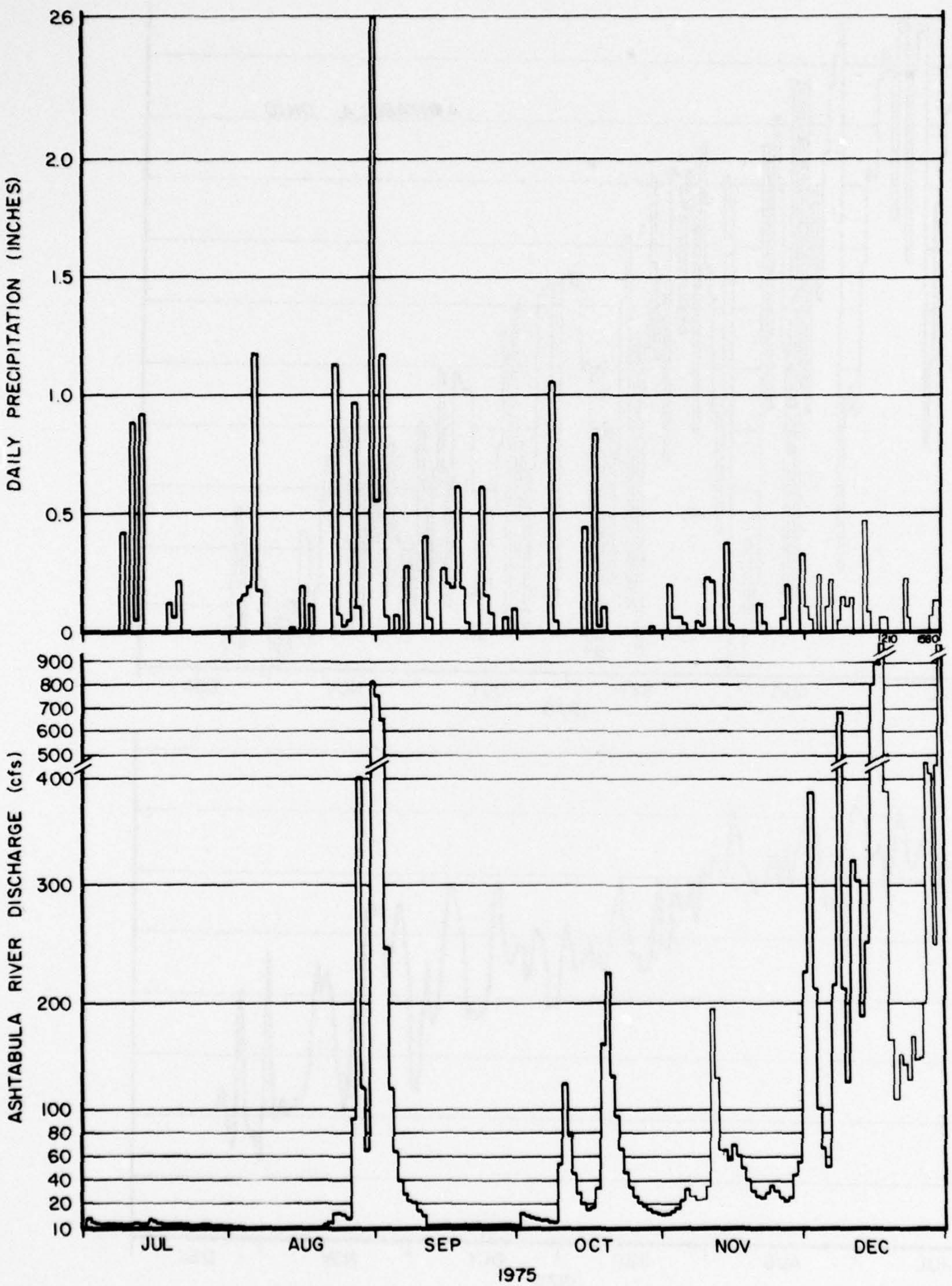


Figure S'1. Daily precipitation and Ashtabula River discharge for July to December 1975

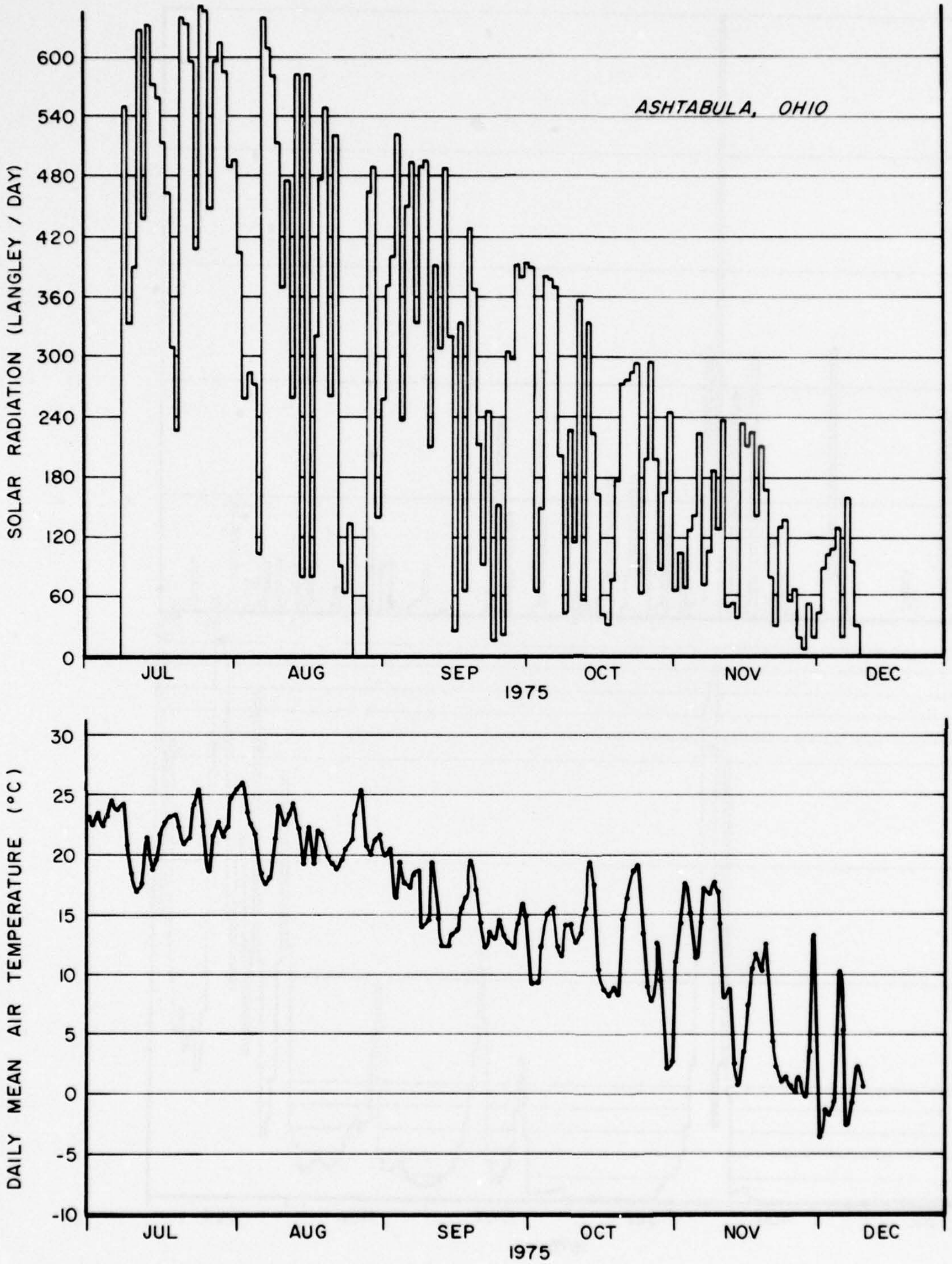


Figure S'2. Daily solar radiation and daily mean temperature for July to December 1975

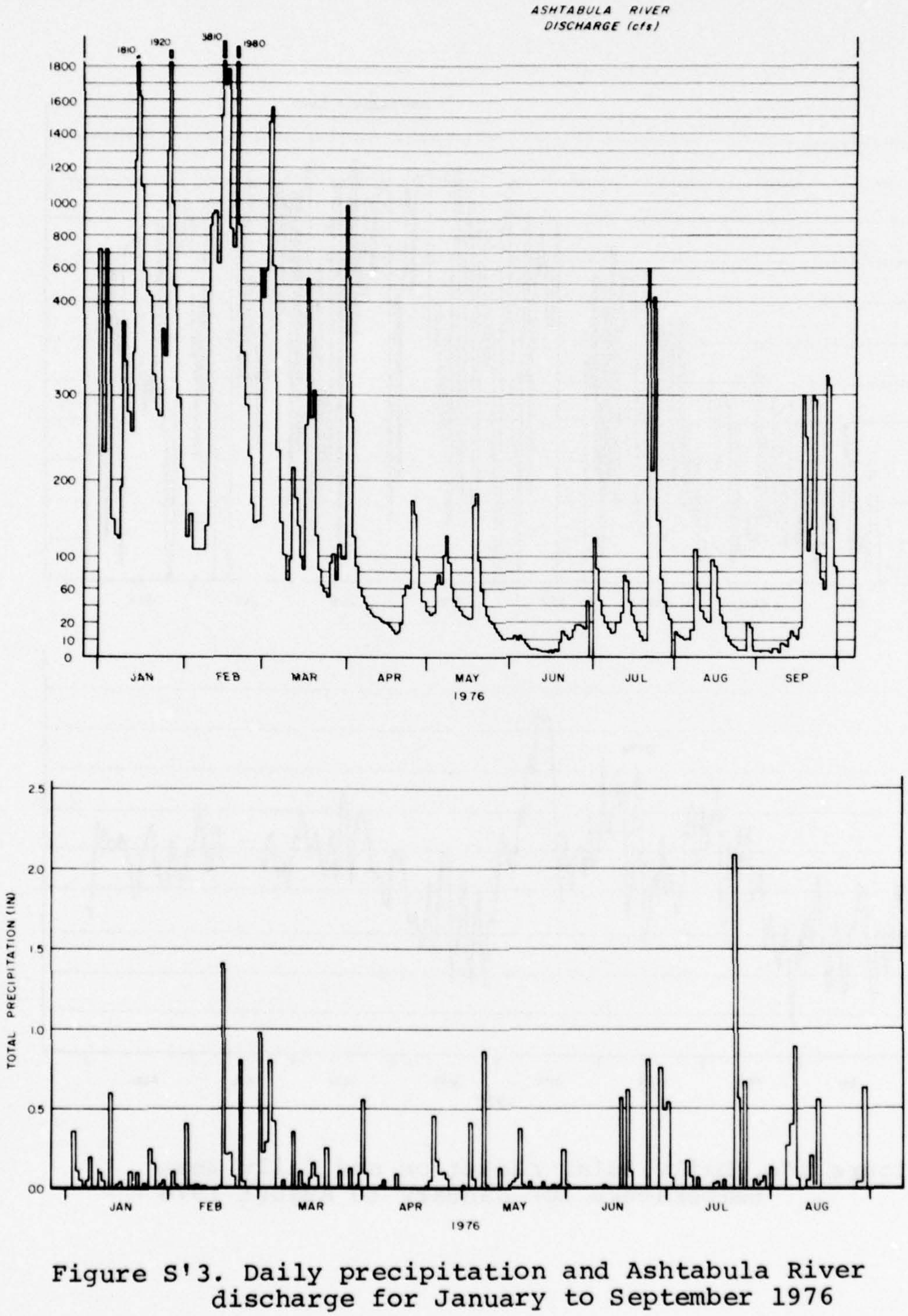


Figure S'3. Daily precipitation and Ashtabula River discharge for January to September 1976

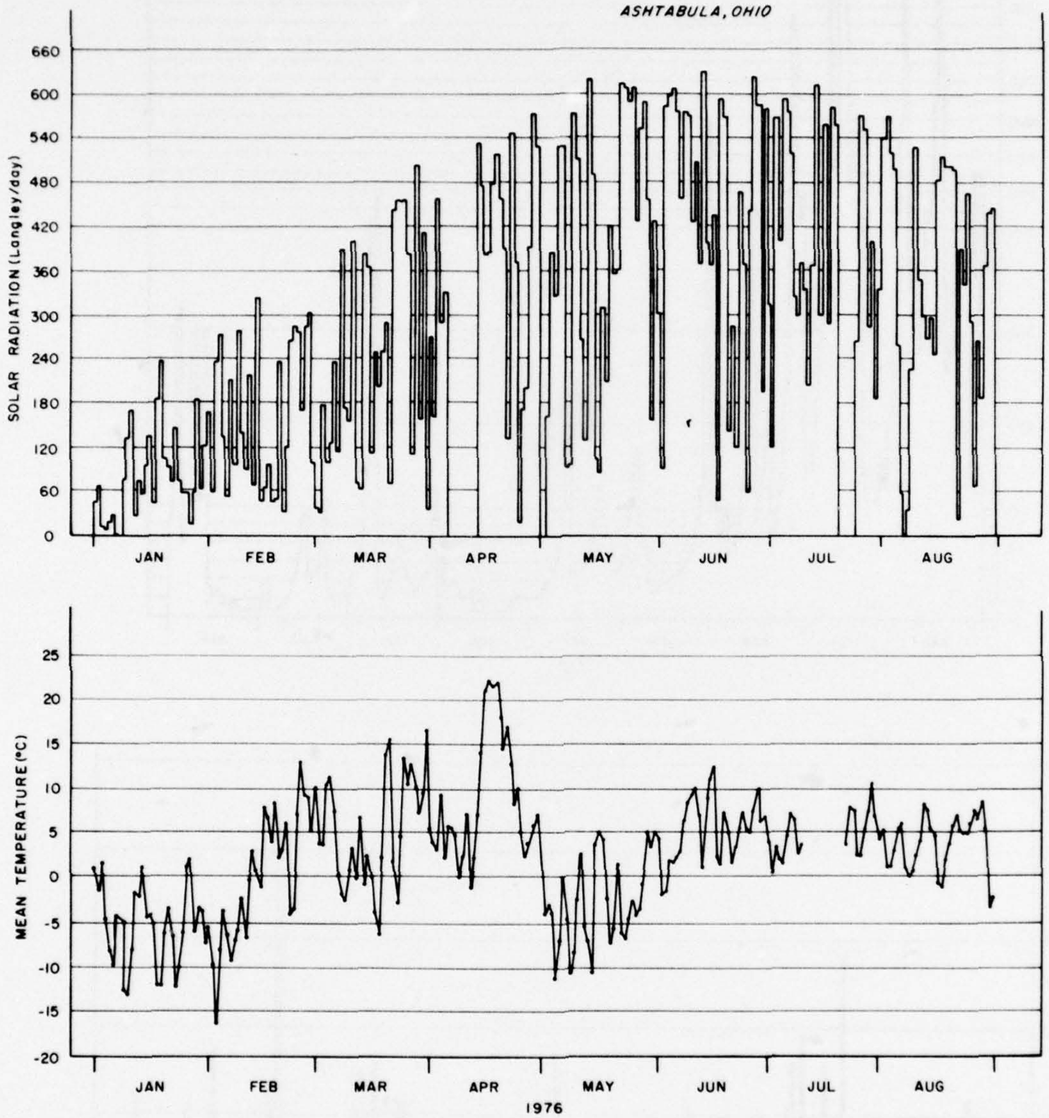


Figure S'4. Daily solar radiation and daily mean temperature for January to August 1976

APPENDIX T': SEDIMENT VANE SHEAR PLOTS AND SEDIMENT CORE RADIOGRAPHS

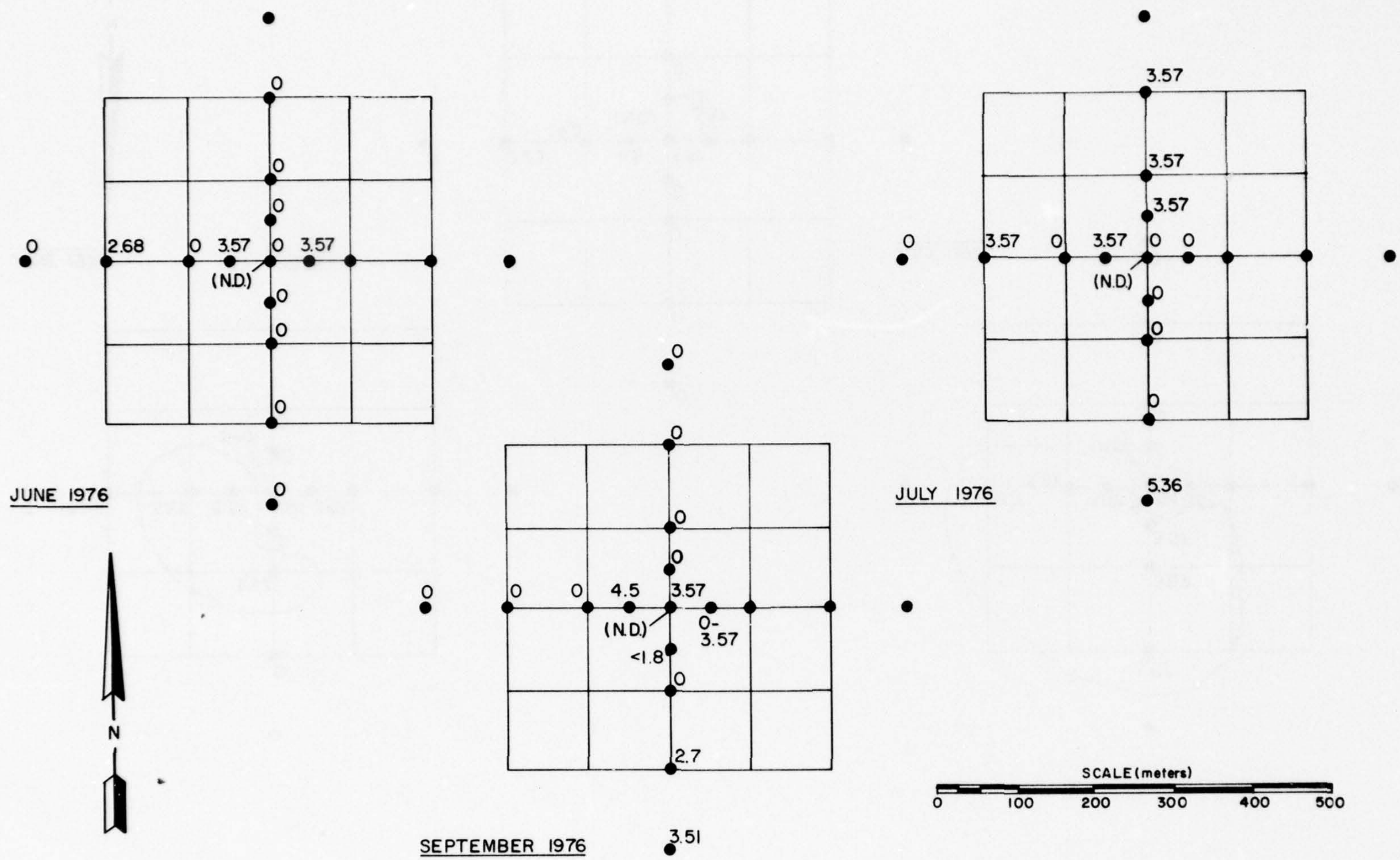


Figure T'1. Shear strength of sediments (pounds per square inch) between 0- and 5- cm depth

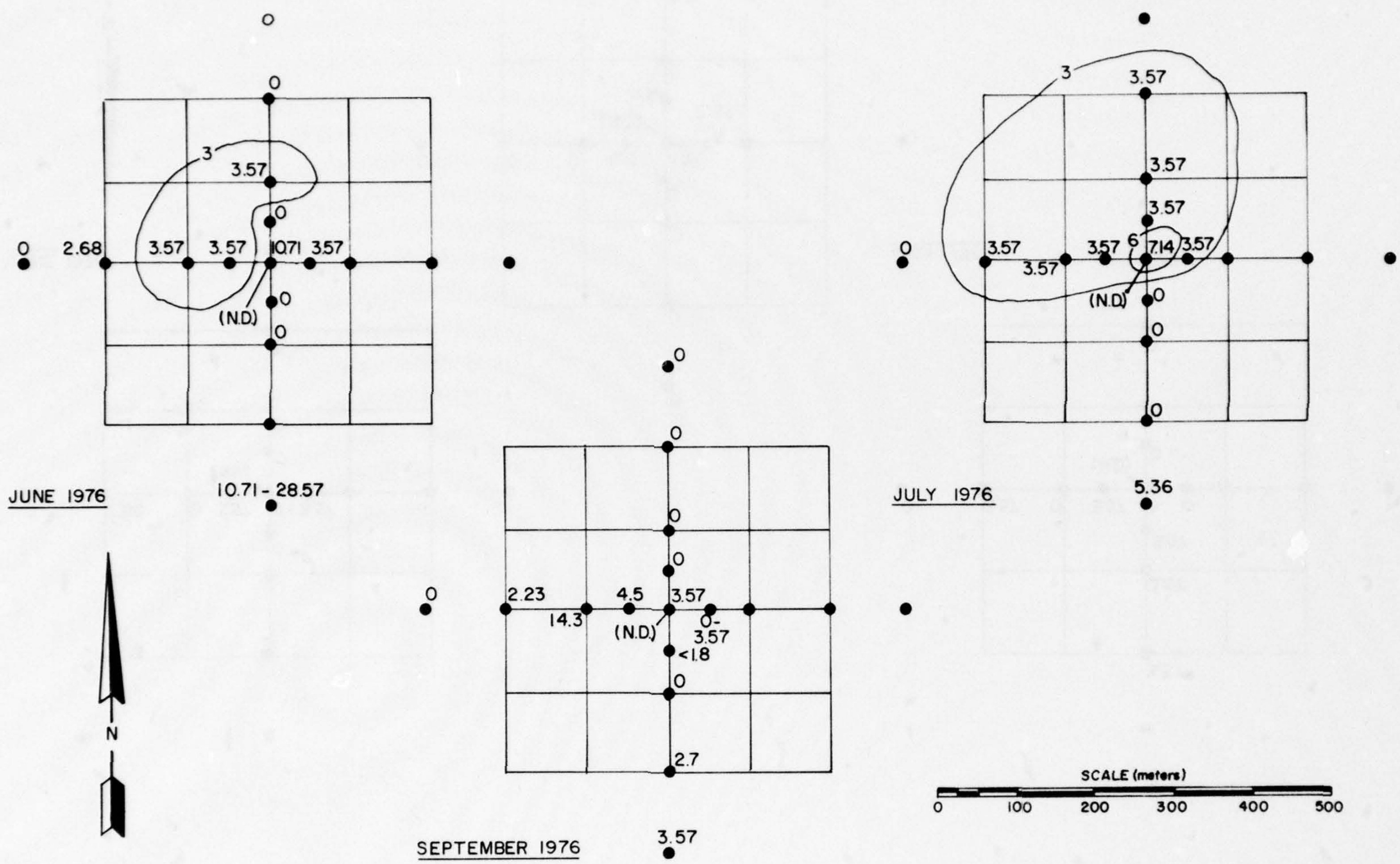


Figure T'2. Shear strength of sediments (pounds per square inch) between 5- and 10- cm depth

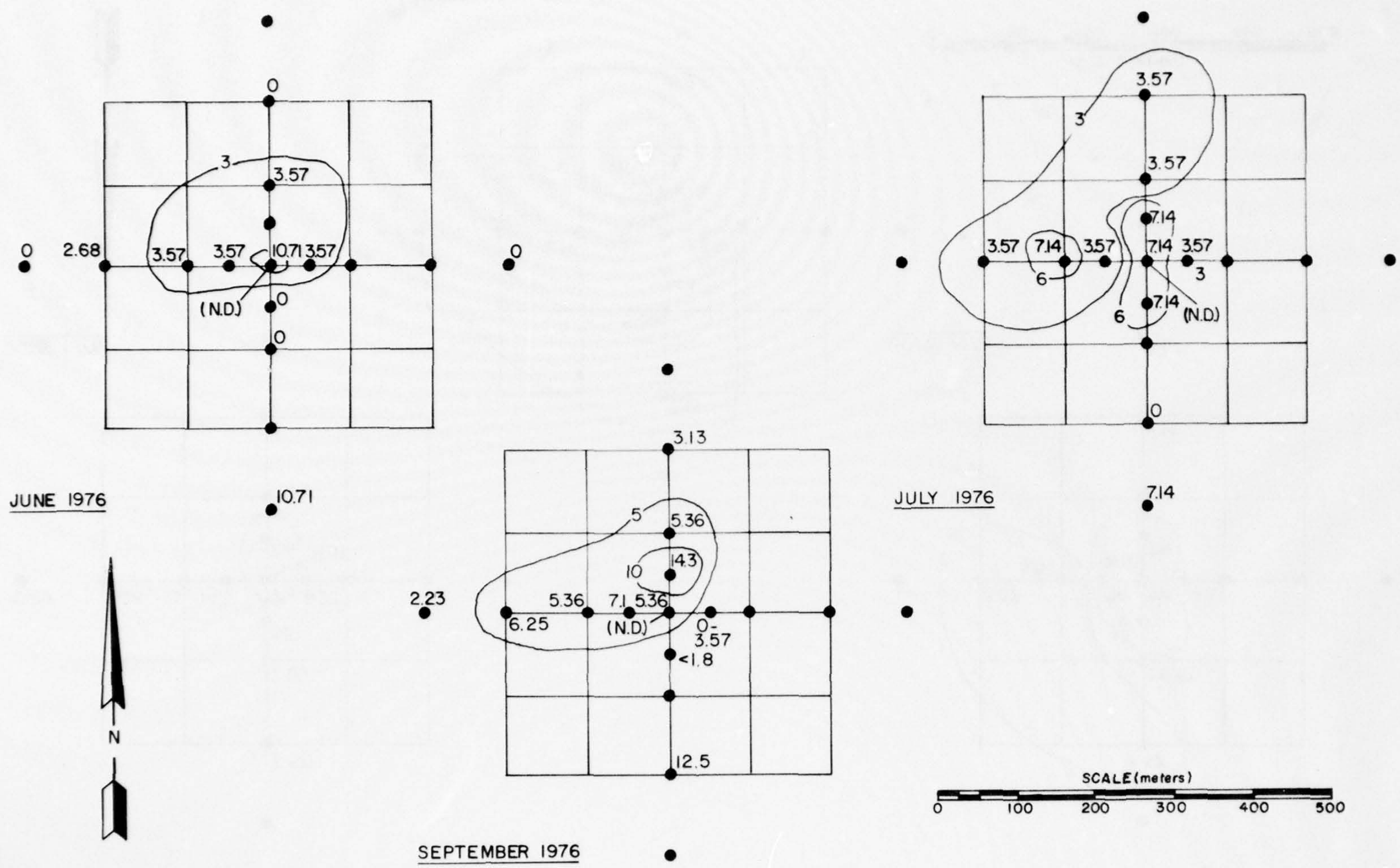


Figure T'3. Shear strength of sediments (pounds per square inch) between 10- and 15- cm depth

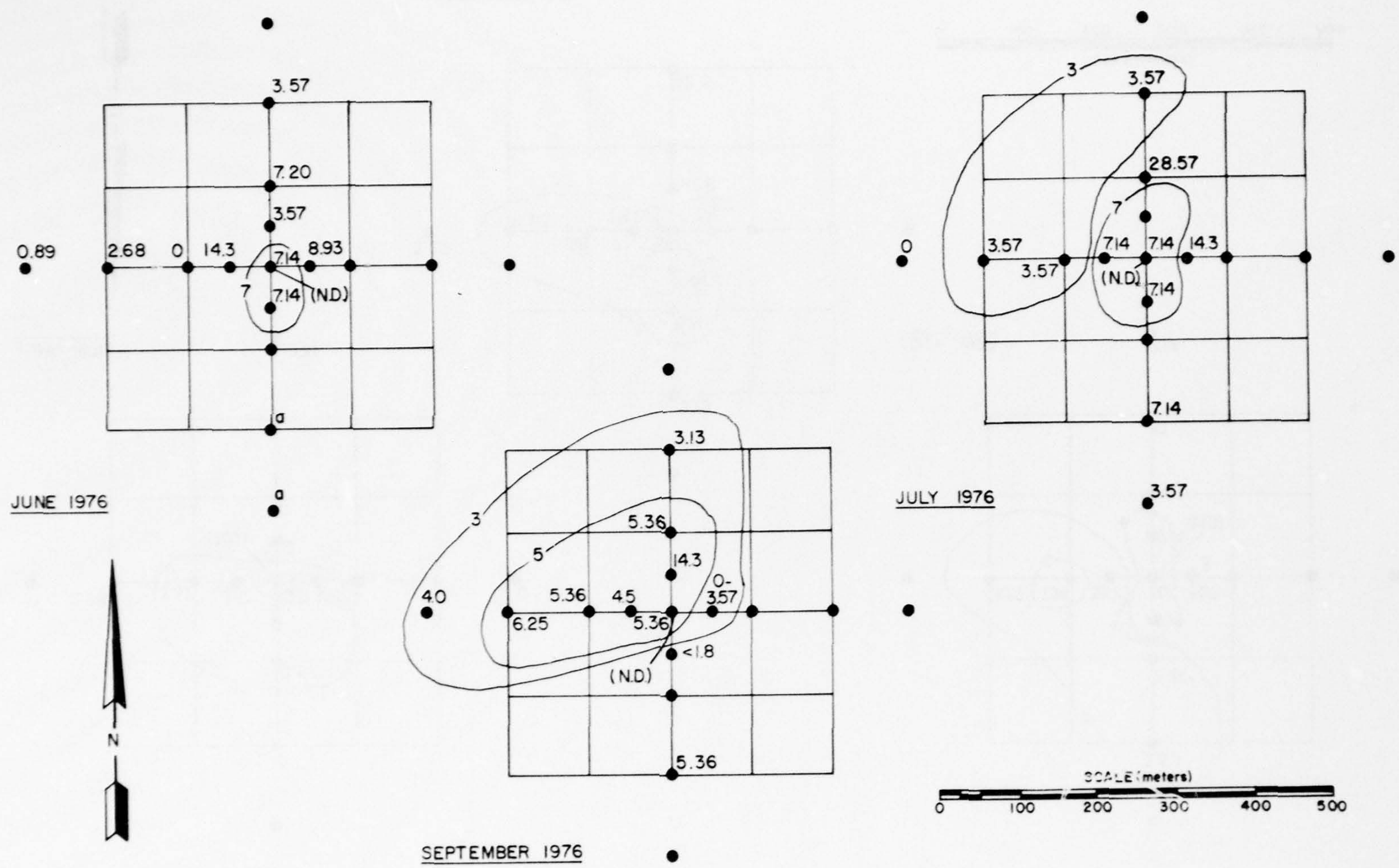


Figure T'4. Shear strength of sediments (pounds per square inch) between 15- and 20- depth (a = missing data)

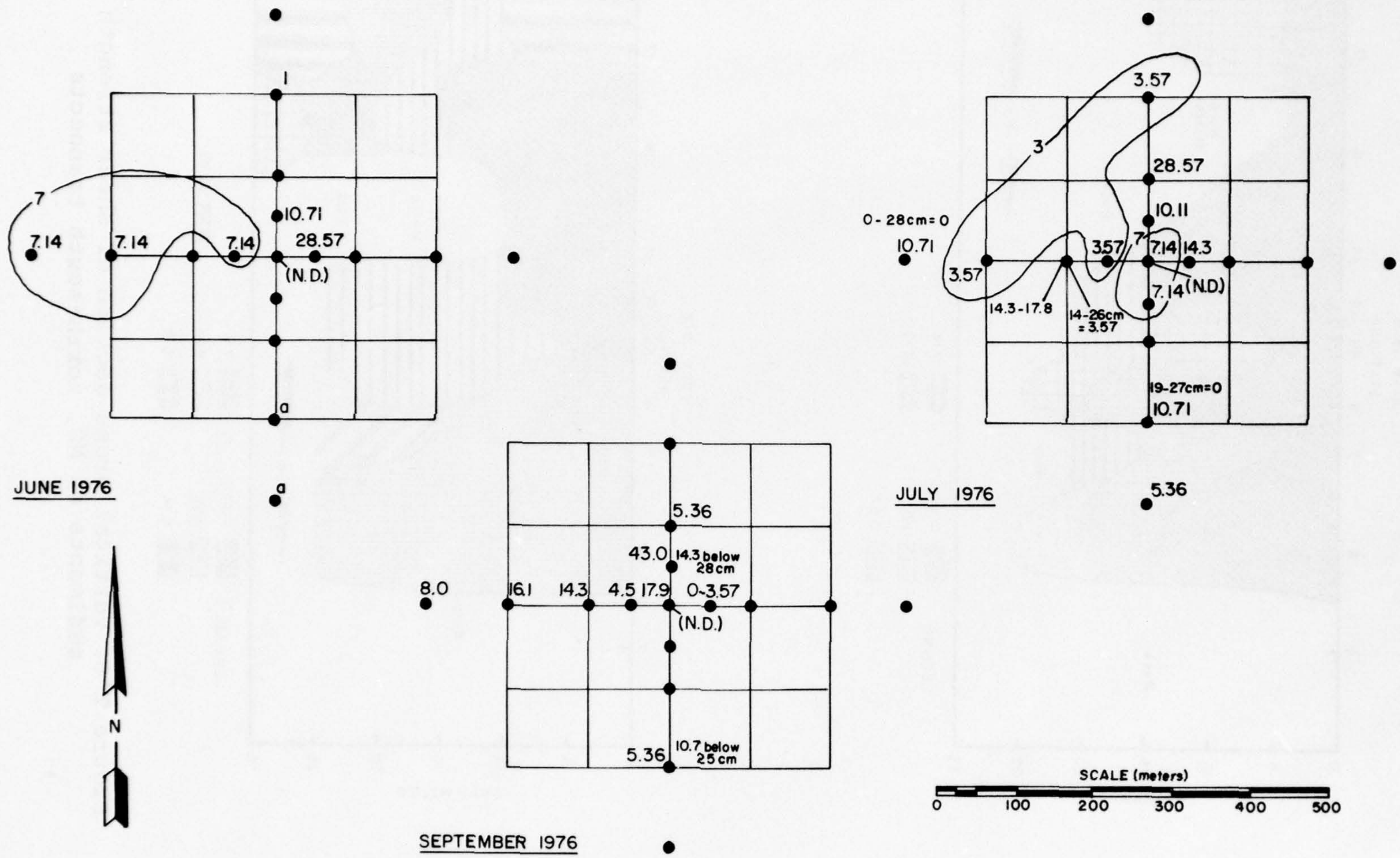


Figure T'5. Shear strength of sediments (pounds per square inch) between 20- and 30- cm depth (a = missing data)

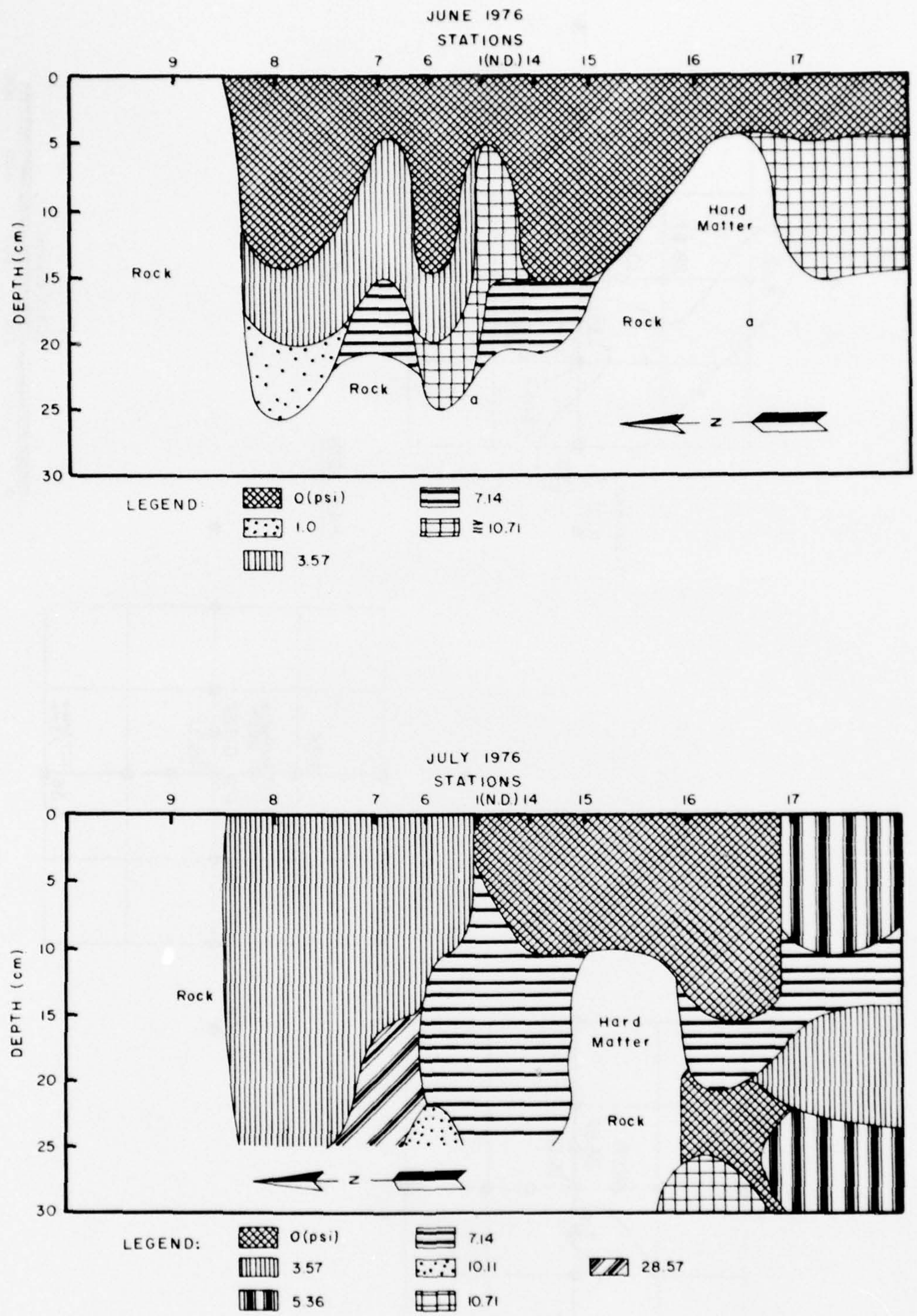
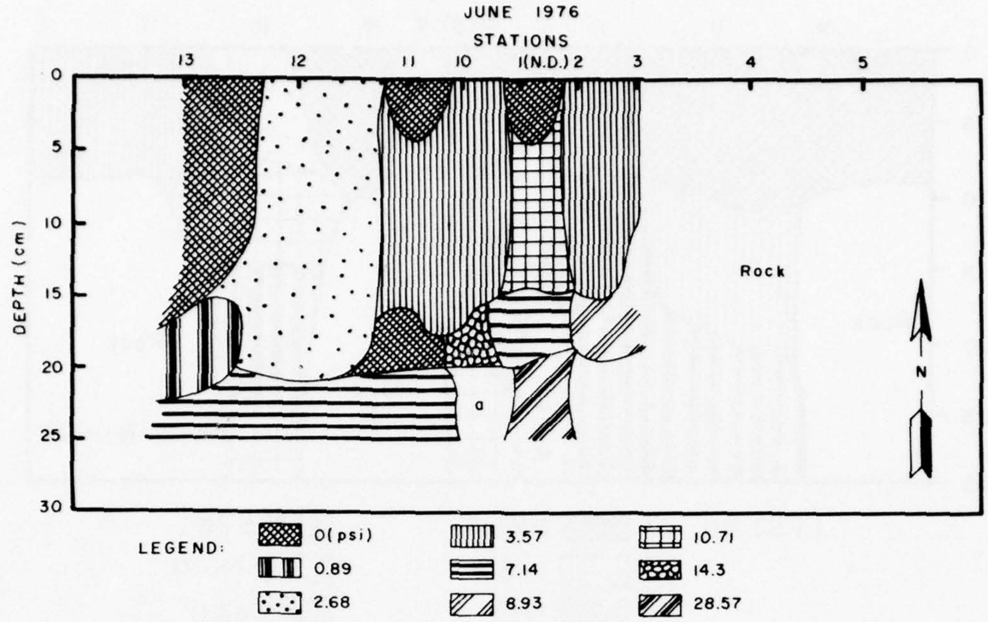


Figure T'6. Vertical cross section of shear strength of sediments at ND, north-south transects



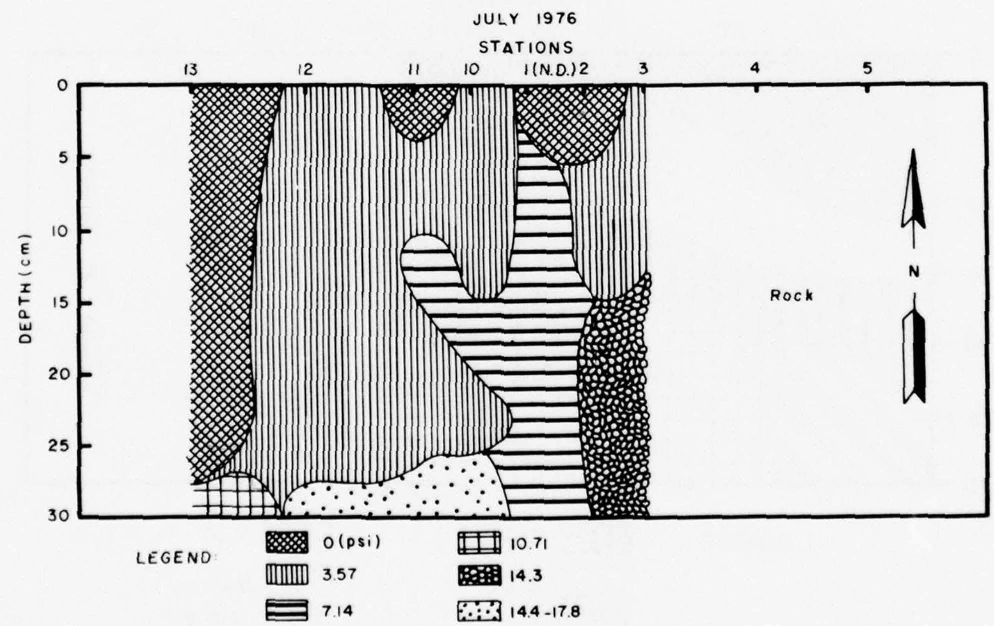
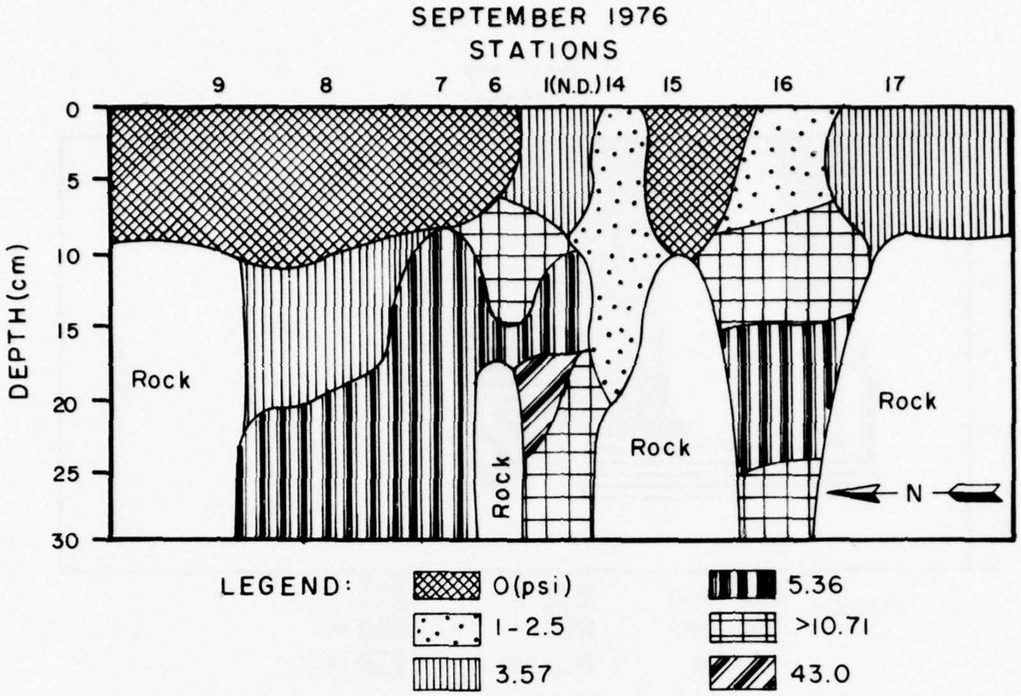


Figure T'7. Vertical cross section of shear strength of sediments at ND, east-west transects



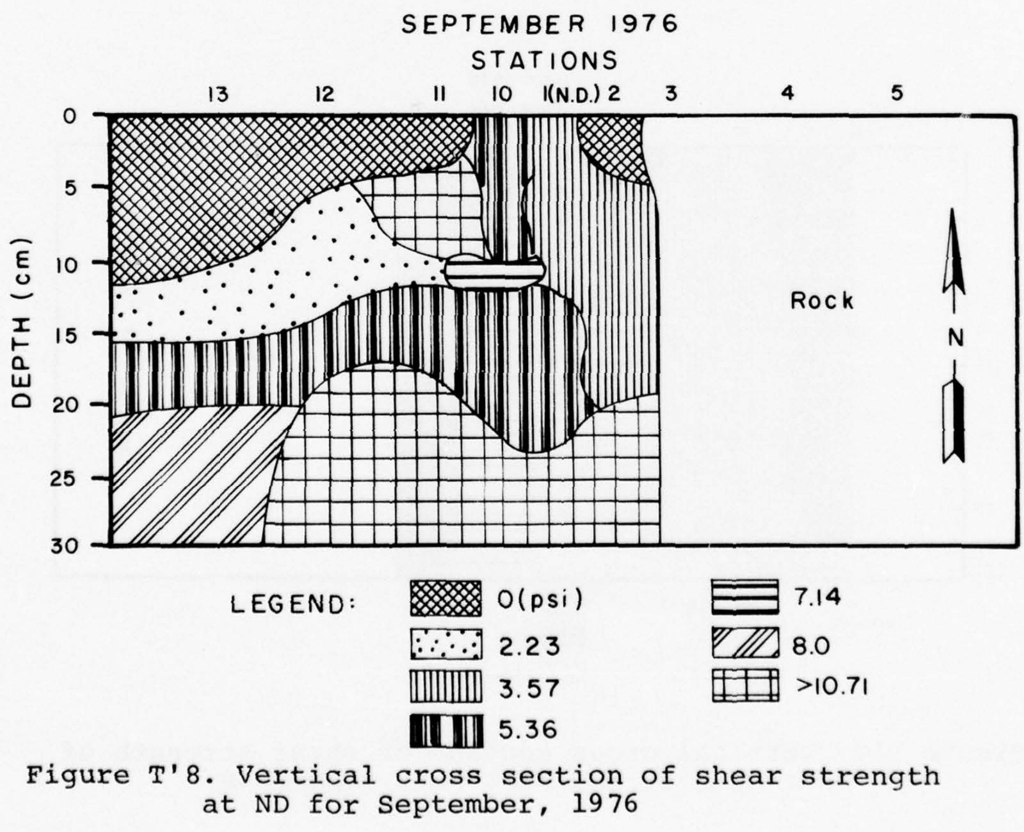


Figure T'8. Vertical cross section of shear strength at ND for September, 1976

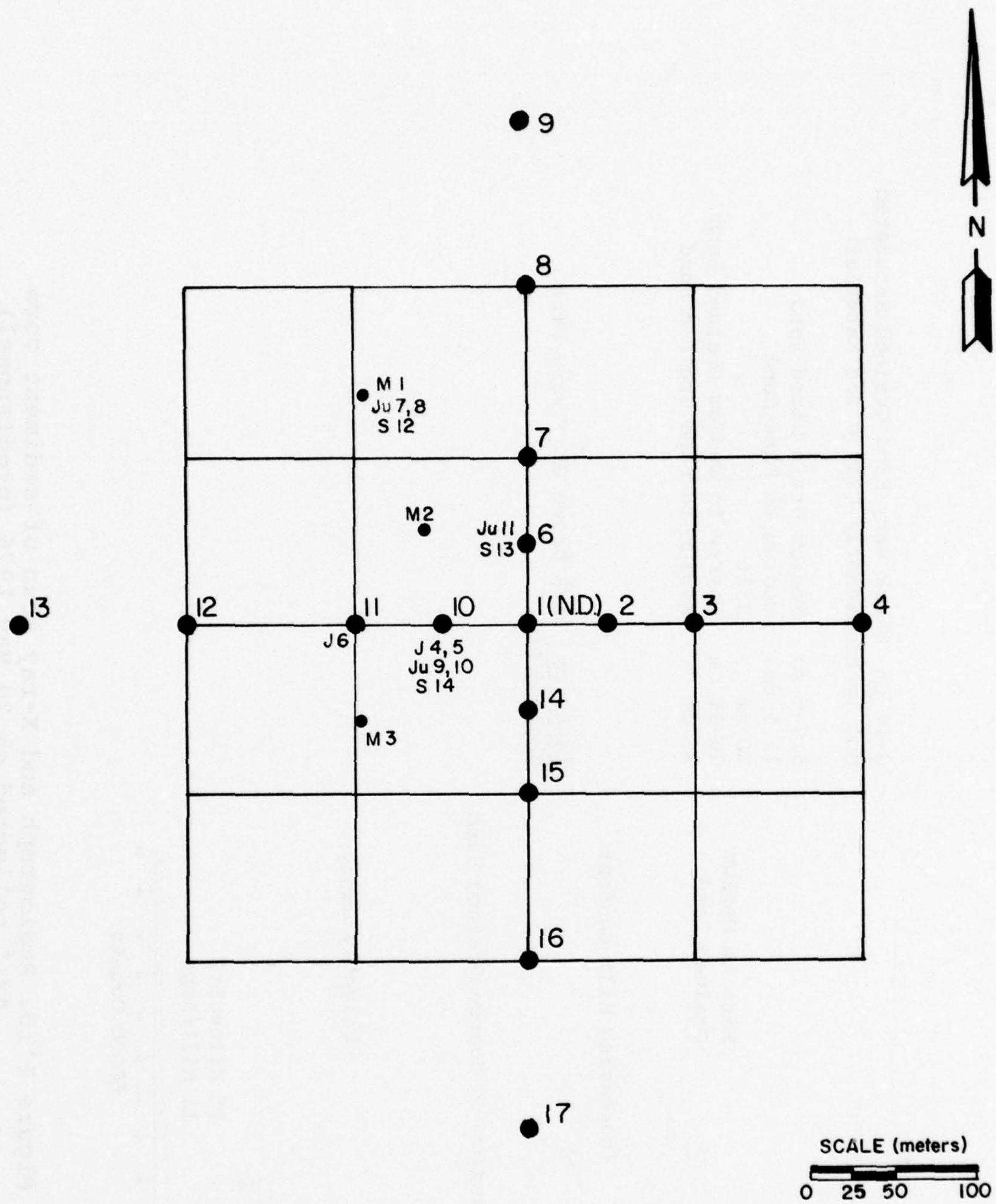
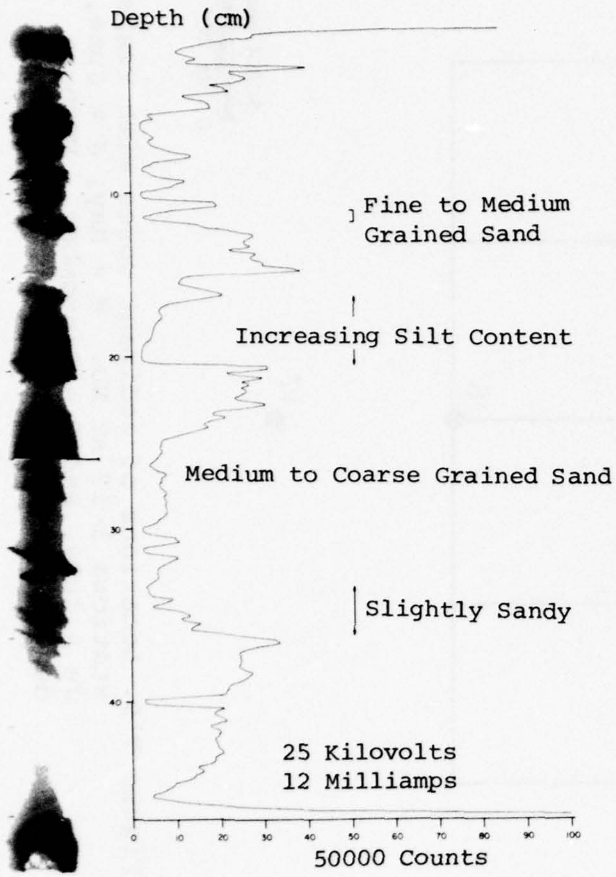


Figure T'9. Locations of sediment cores with respect to stations 1-17 at ND. M = May, J = June, Ju = July, and S = September. Numbers denote core samples



<u>0-14 cm</u> Black very Fine Grained Saturated Mud (predominantly Clay sized Material).

5.5-6 cm	Medium Grain Sized Sand
11.5 cm	Medium to Fine Sand
20 cm	Silt
30-31 cm	Coarse to Medium Grained Sand
35 cm	Medium to Fine Grained Sand

<u>14-48 cm</u> Dark Brown Gray very Fine Grained Mud.

Figure T'10. Radiograph and X-ray scan of sediment core "M1" collected on 20 May 1976 (predisposal)

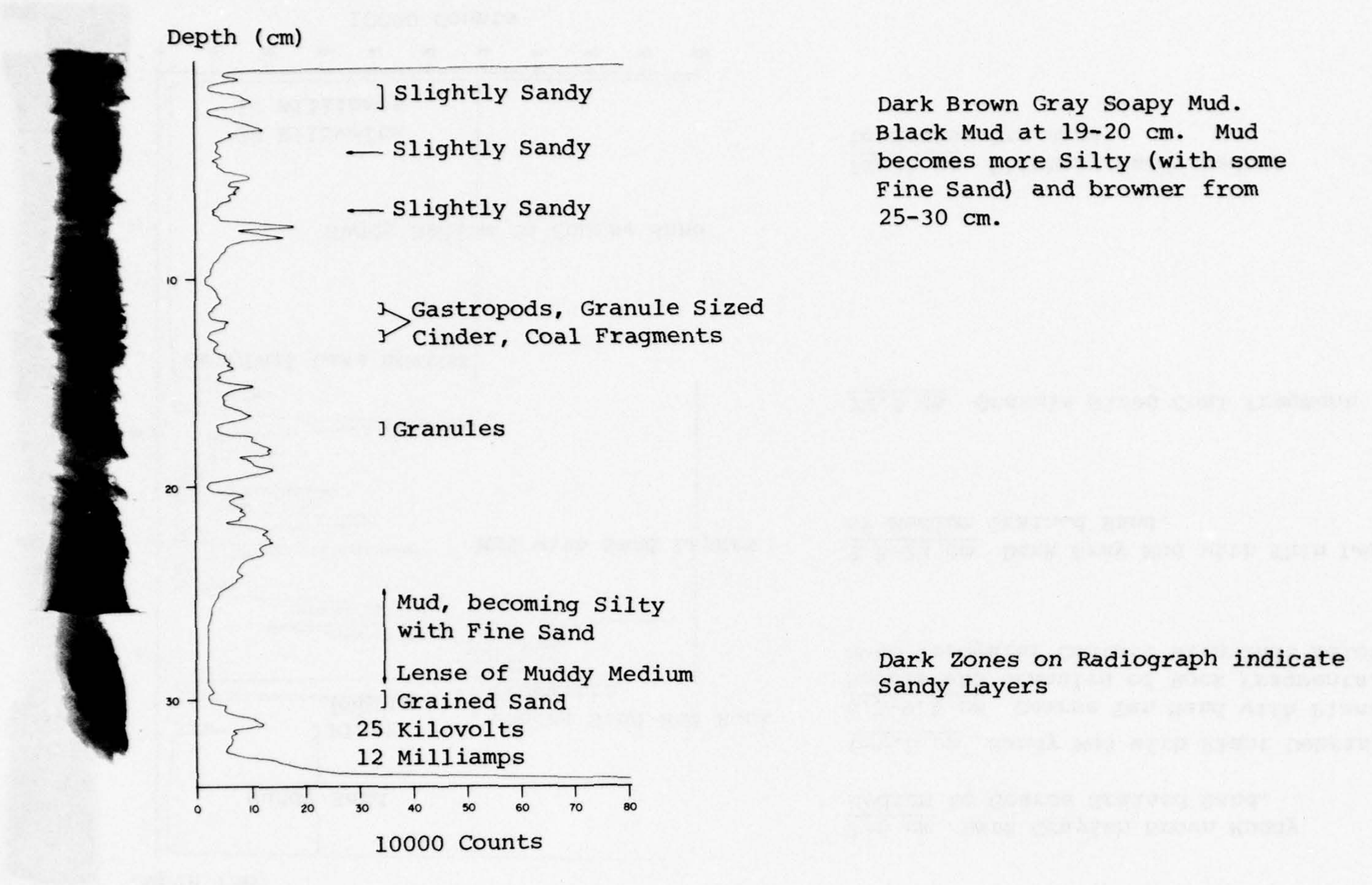
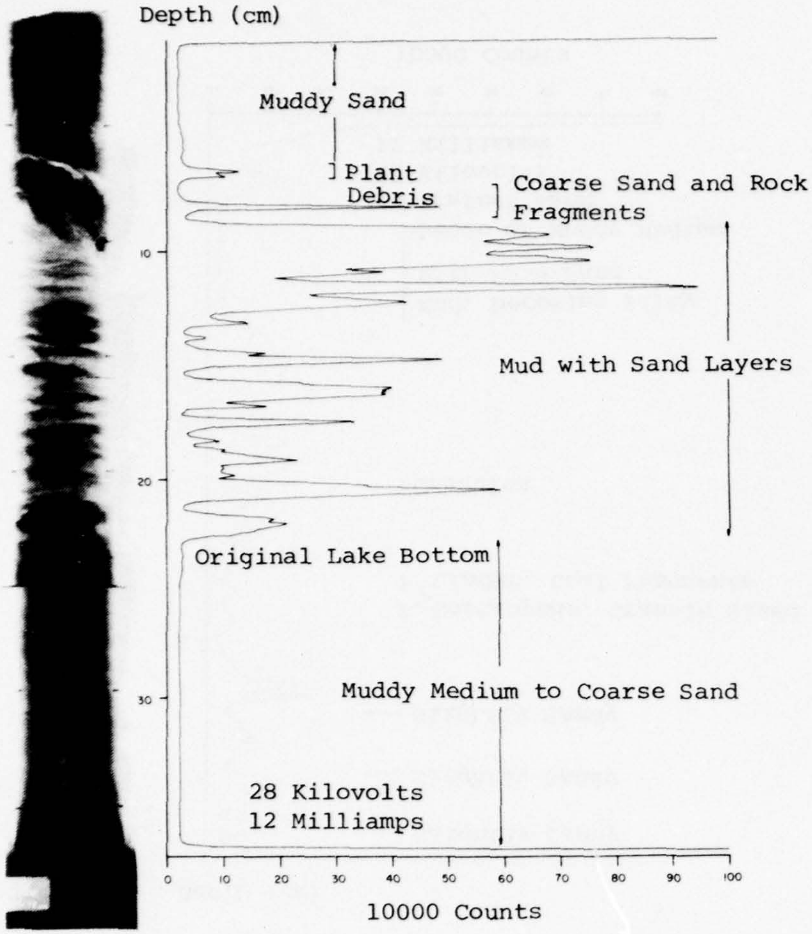


Figure T'11. Radiograph and X-ray scan of sediment core "M3" collected on 20 May 1976 (predisposal)



0-6 cm Dark Grayish Brown Muddy Medium to Coarse Grained Sand.

6-6.5 cm Sandy Mud with Plant Debris

6.5-9.5 cm Coarse Tan Sand with Plant Debris and Granules of Rock Fragments. Note Irregular Contact with Unit below.

9.5-23 cm Dark Gray Mud with Thin Lenses of Medium Grained Sand.

22.5 cm Granule Sized Coal Fragment

23-38 cm Slightly Muddy Medium to Coarse Tan Sand.

Figure T'12. Radiograph and X-ray scan of sediment core "J4" collected on 10 June 1976

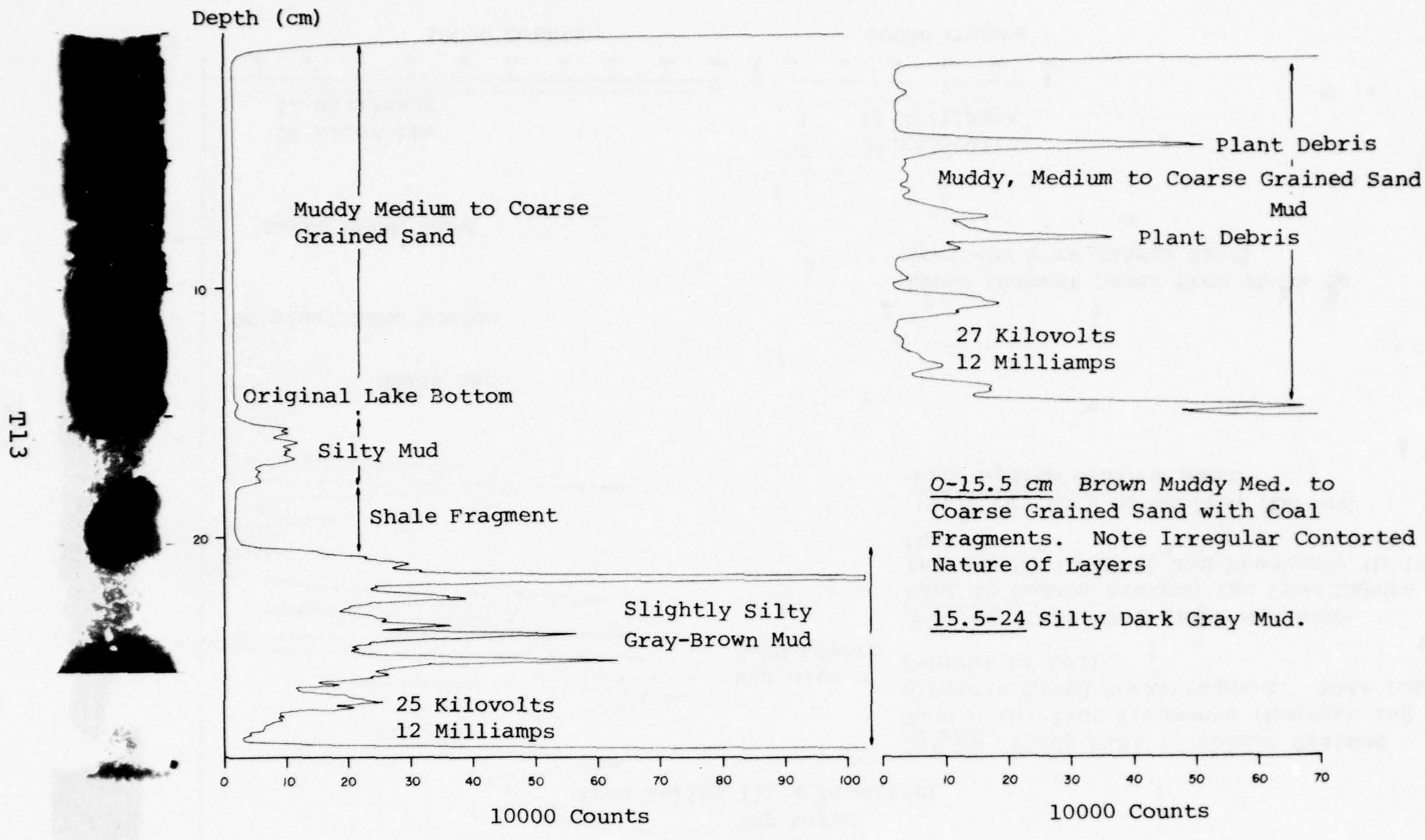


Figure T'13. Radiograph and X-ray scan of sediment core "J6" collected on 13 June 1976

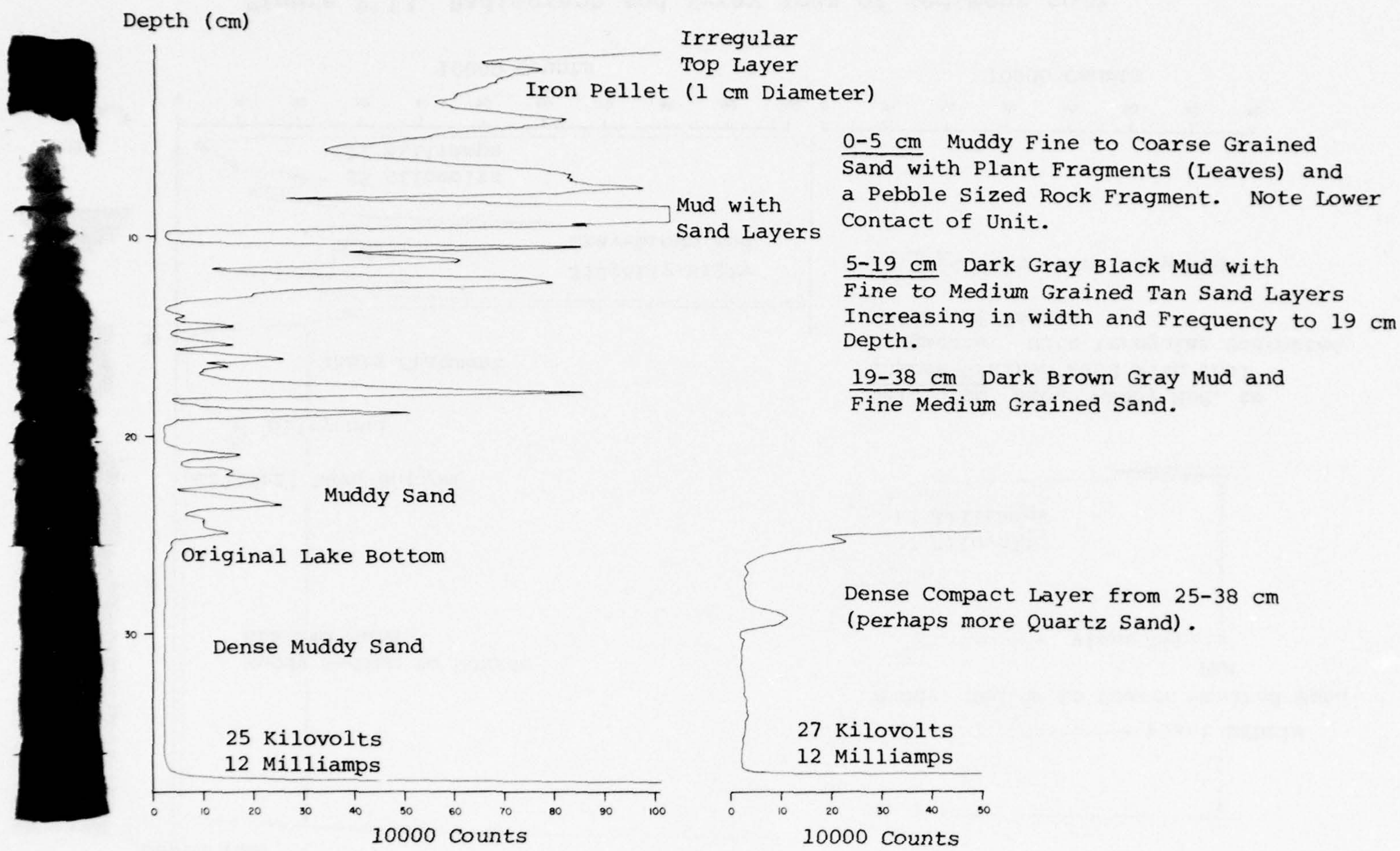
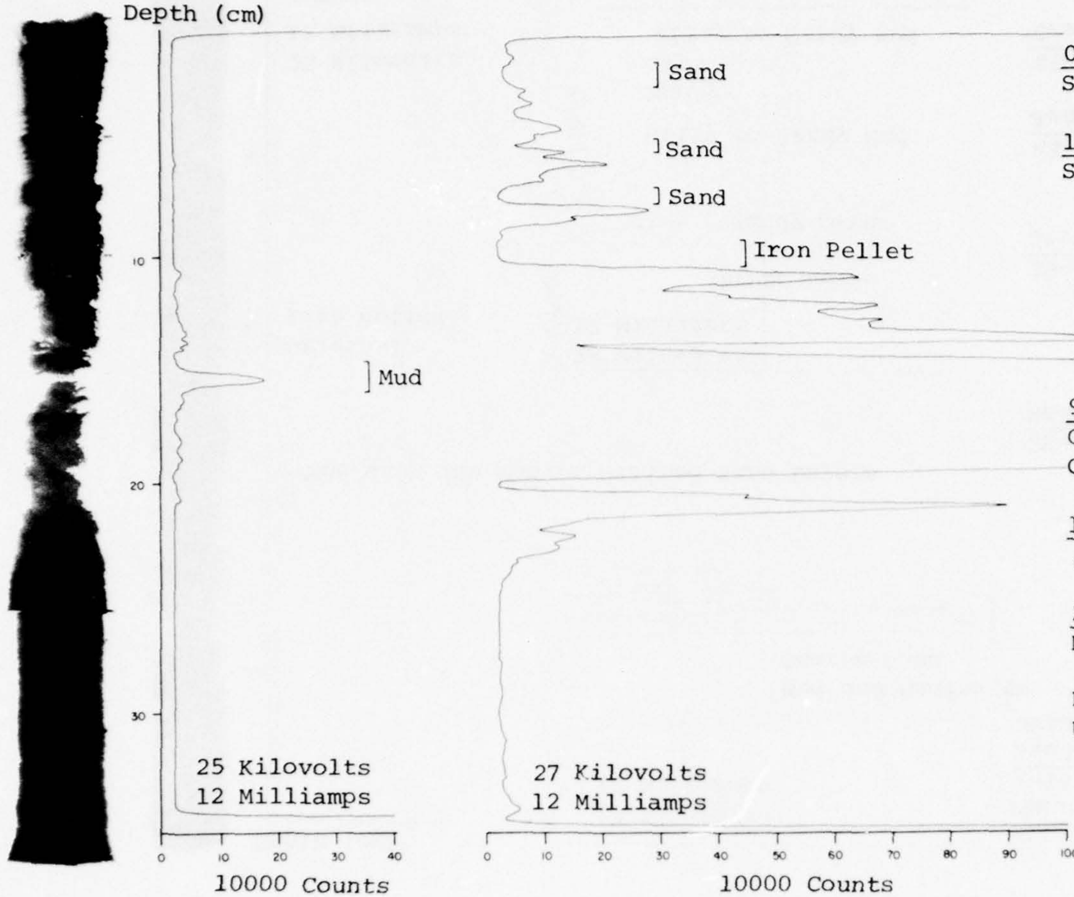


Figure T'14. Radiograph and X-ray scan of sediment core "Ju7" collected on 9 July 1976

T15



0-1 cm Dark Gray Silty to Sandy Mud with Leaves.

1-3 cm Muddy Tan Medium Grained Sand.

3-7 cm Dark Brown Gray Sandy Mud.

7-8 cm Fine-Medium Grained Tan Sand.

8-9 cm Sandy Mud.

9-14 cm Muddy Medium to Coarse Grained Grayish Brown Sand with Coal Fragments, Shale Fragment.

14-22 cm Slightly Silty Dark Gray Mud.

22-35 cm Muddy Dark Gray-Tan Medium Grained Sand.

Note Irregular Contorted Nature of Upper 14 cm.

Figure T'15. Radiograph and X-ray scan of sediment core "Ju8" collected on 9 July 1976

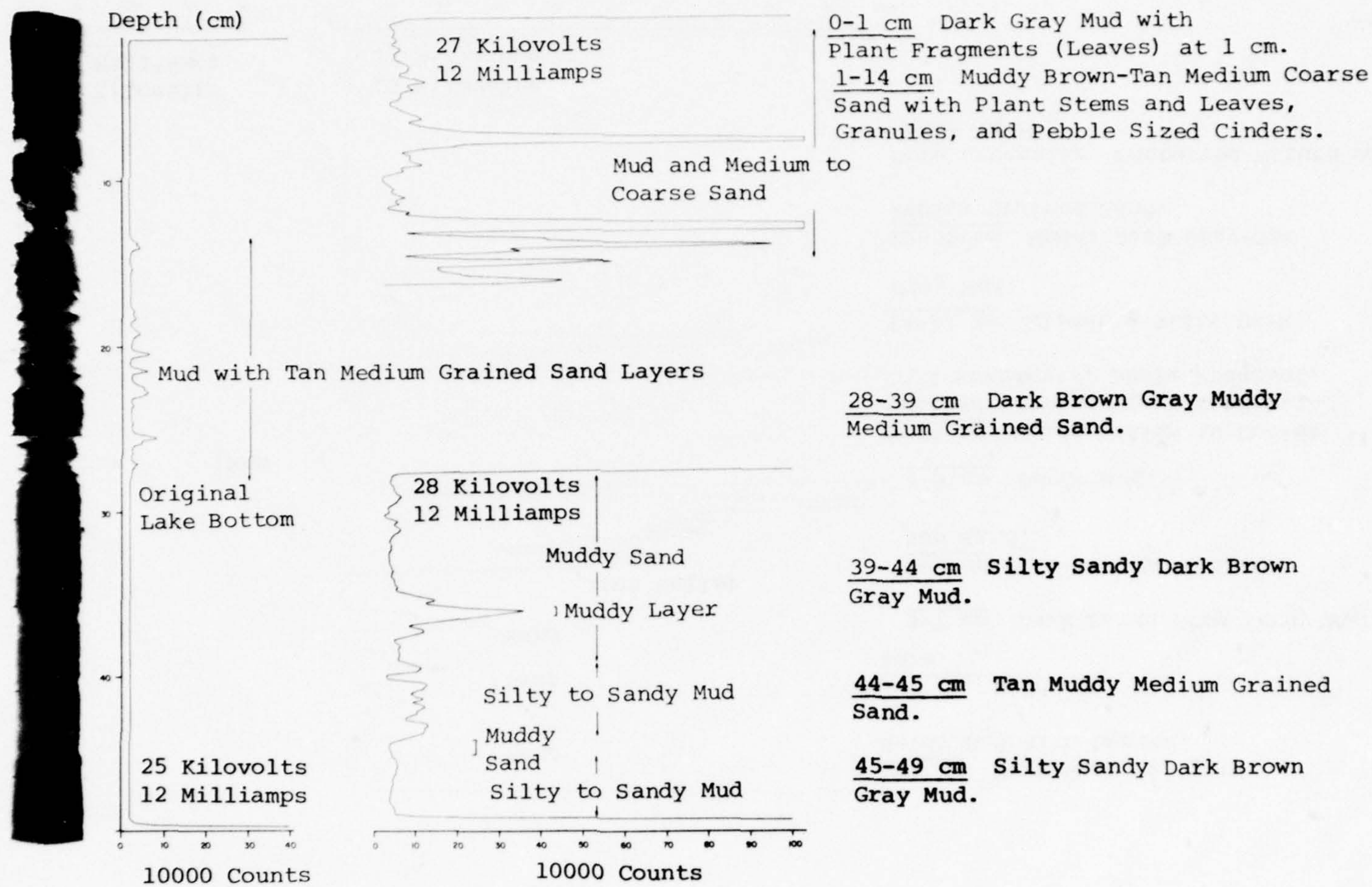


Figure T'16. Radiograph and X-ray scan of sediment core "Ju9" collected on 9 July 1976

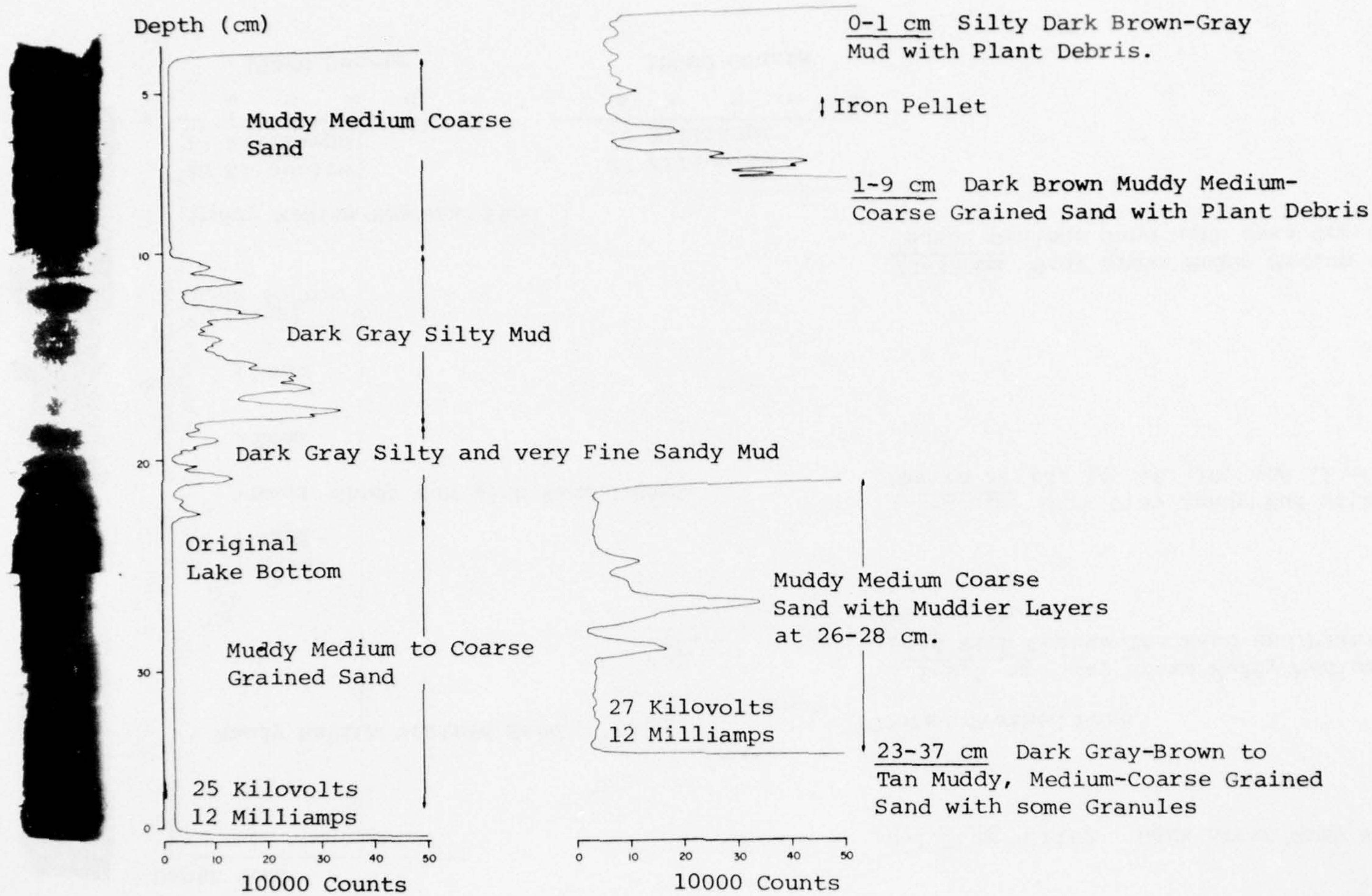


Figure T'17. Radiograph and X-ray scan of sediment core "Jul0" collected on 9 July 1976

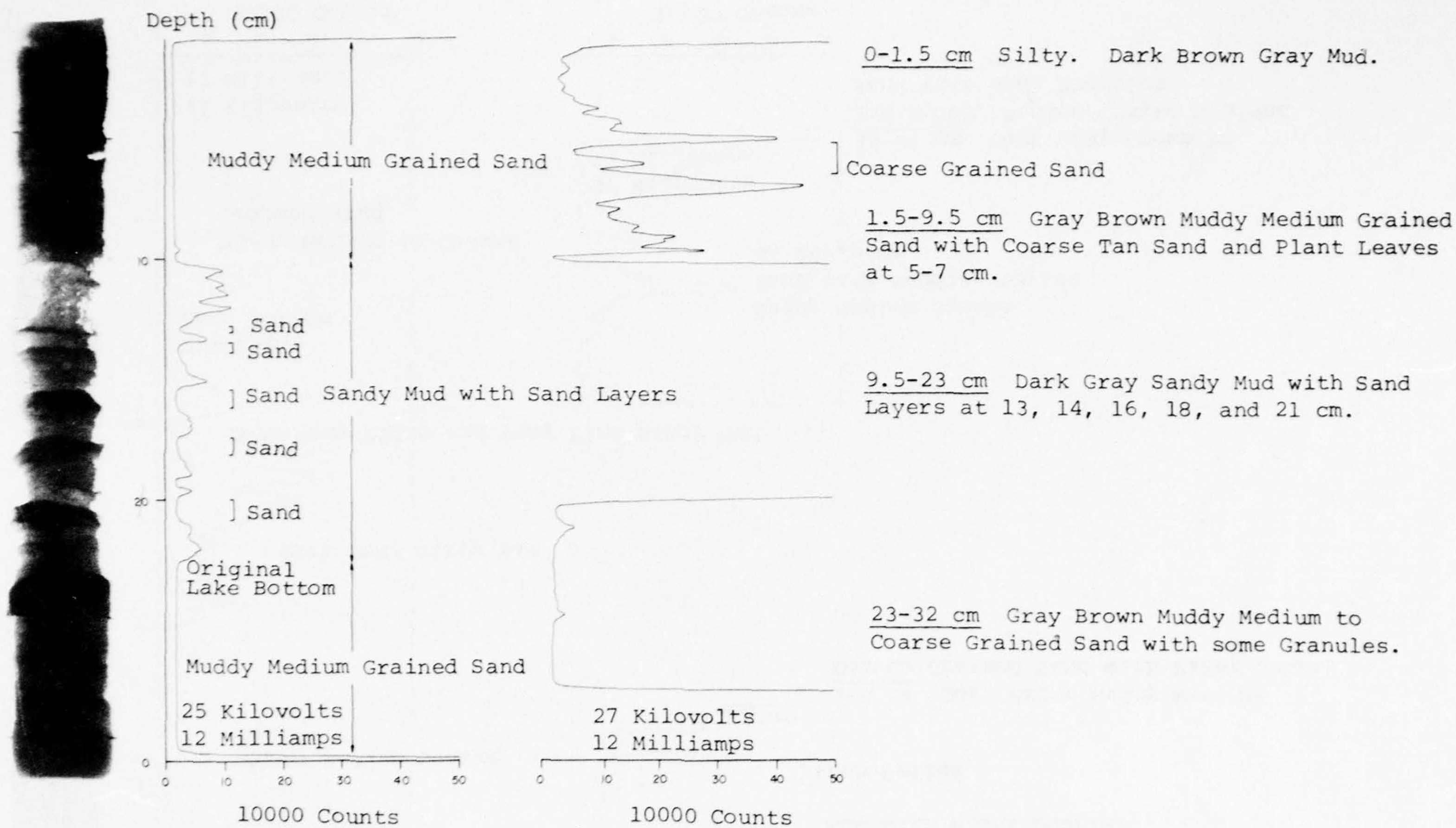


Figure T'18. Radiograph and X-ray scan of sediment core "Jull" collected on 9 July 1976

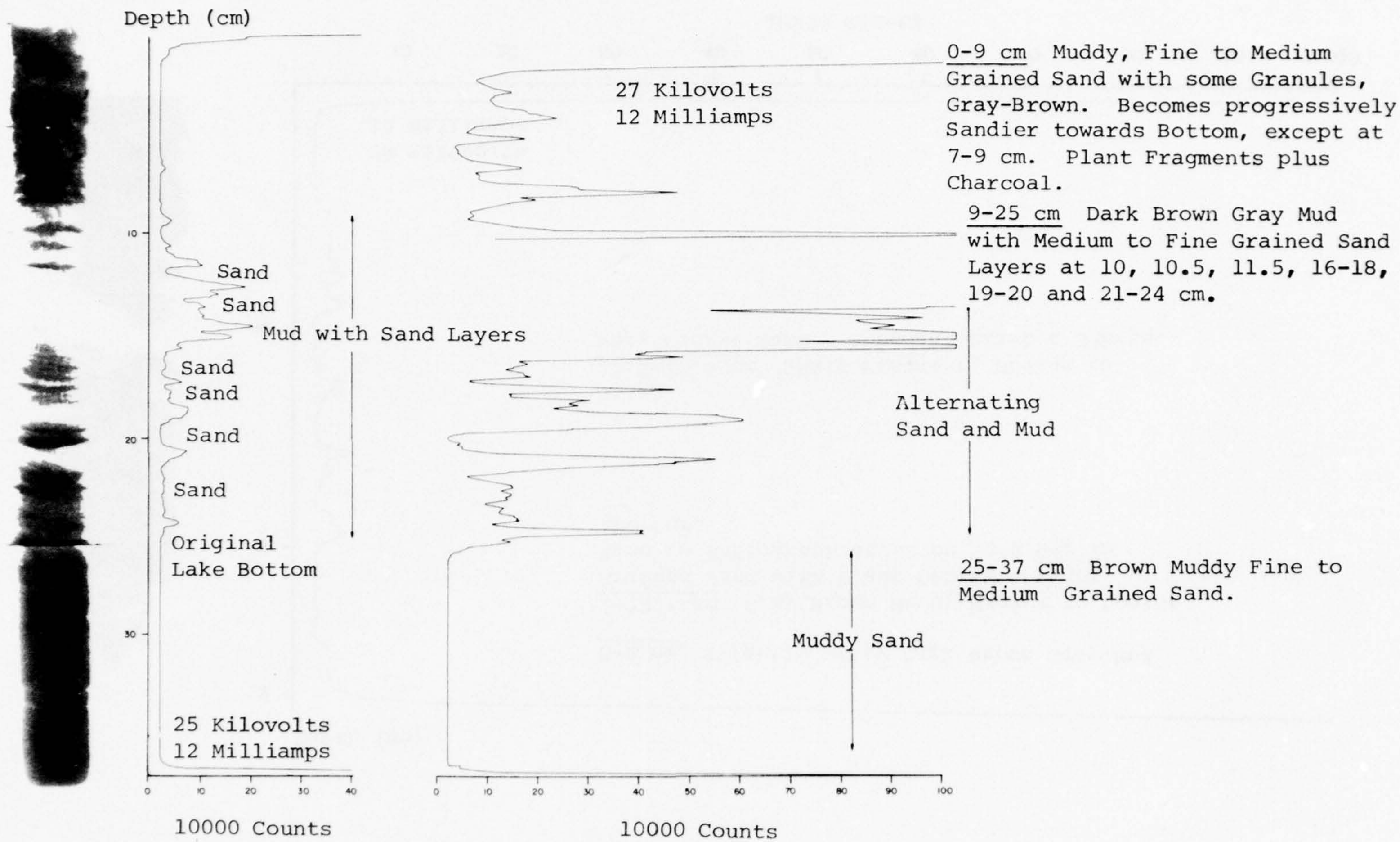


Figure T'19. Radiograph and X-ray scan of sediment core "S12" collected on 14 September 1976

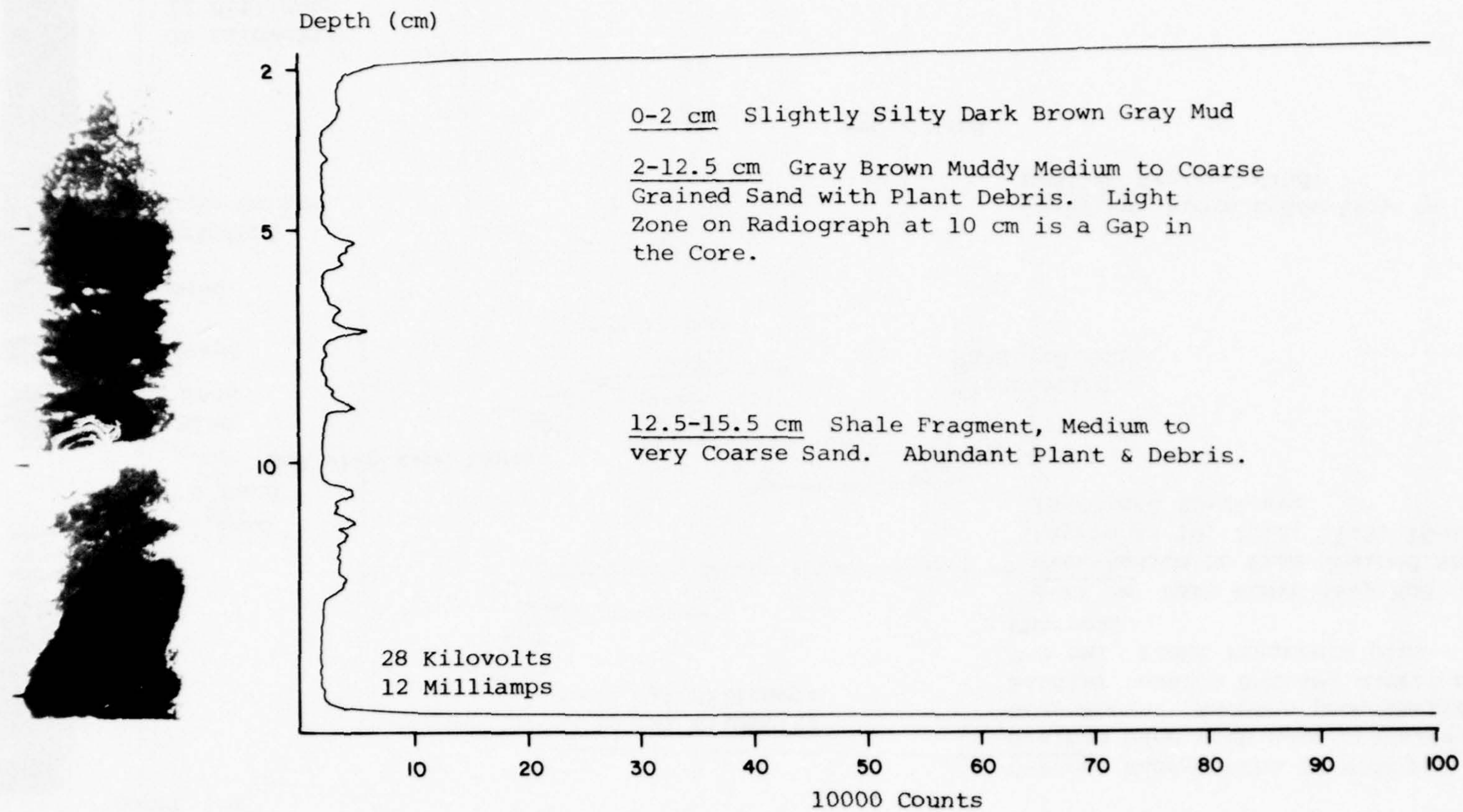


Figure T'20. Radiograph and X-ray scan of sediment core "S13" collected on 9 September 1976

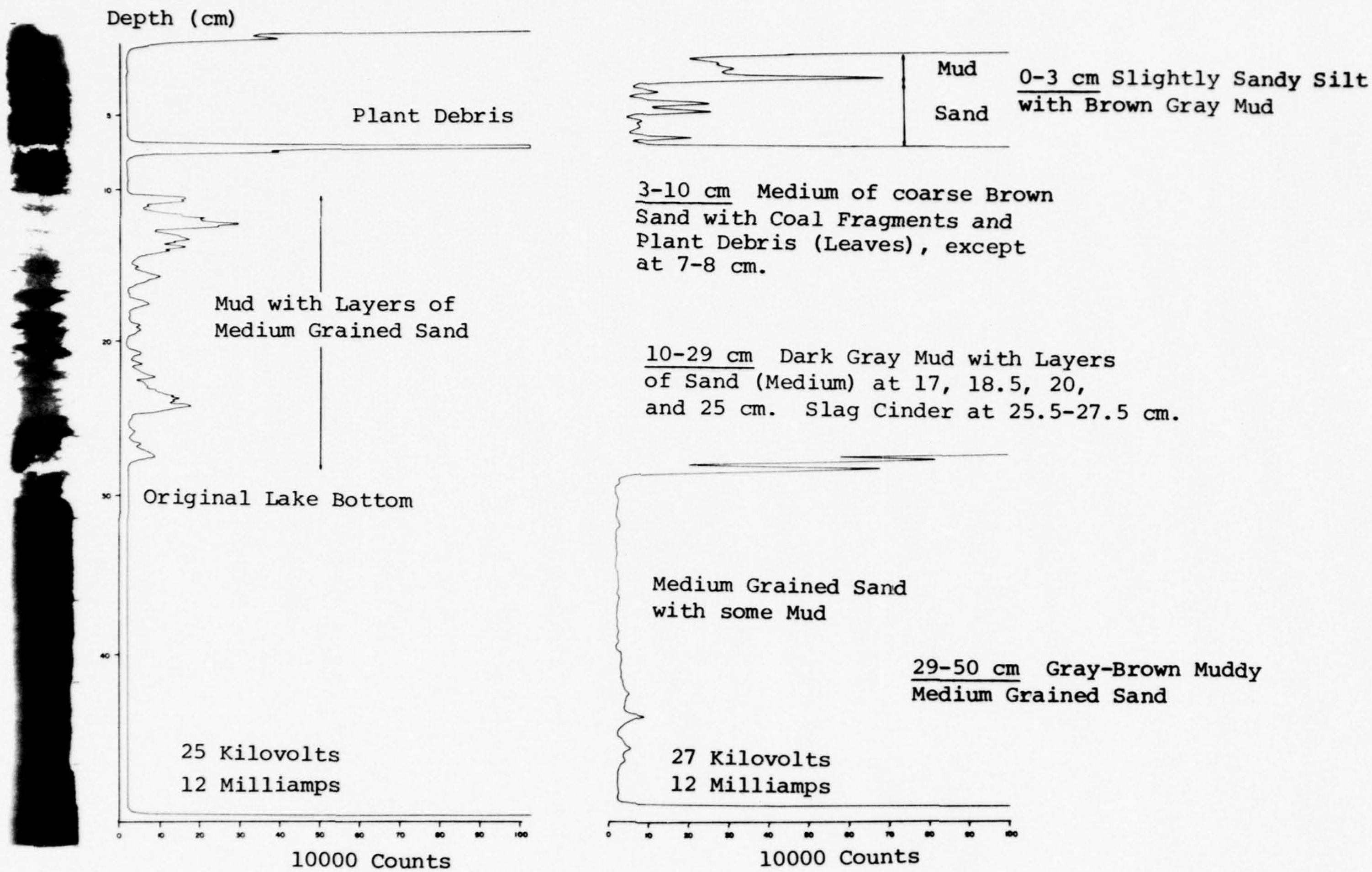


Figure T'21. Radiograph and X-ray scan of sediment core "S14" collected on 9 September 1976

APPENDIX U': SEDIMENT CORE ANALYSIS: GRAIN-SIZE DISTRIBUTIONS AND DISCRIMINATE FUNCTION PLOTS

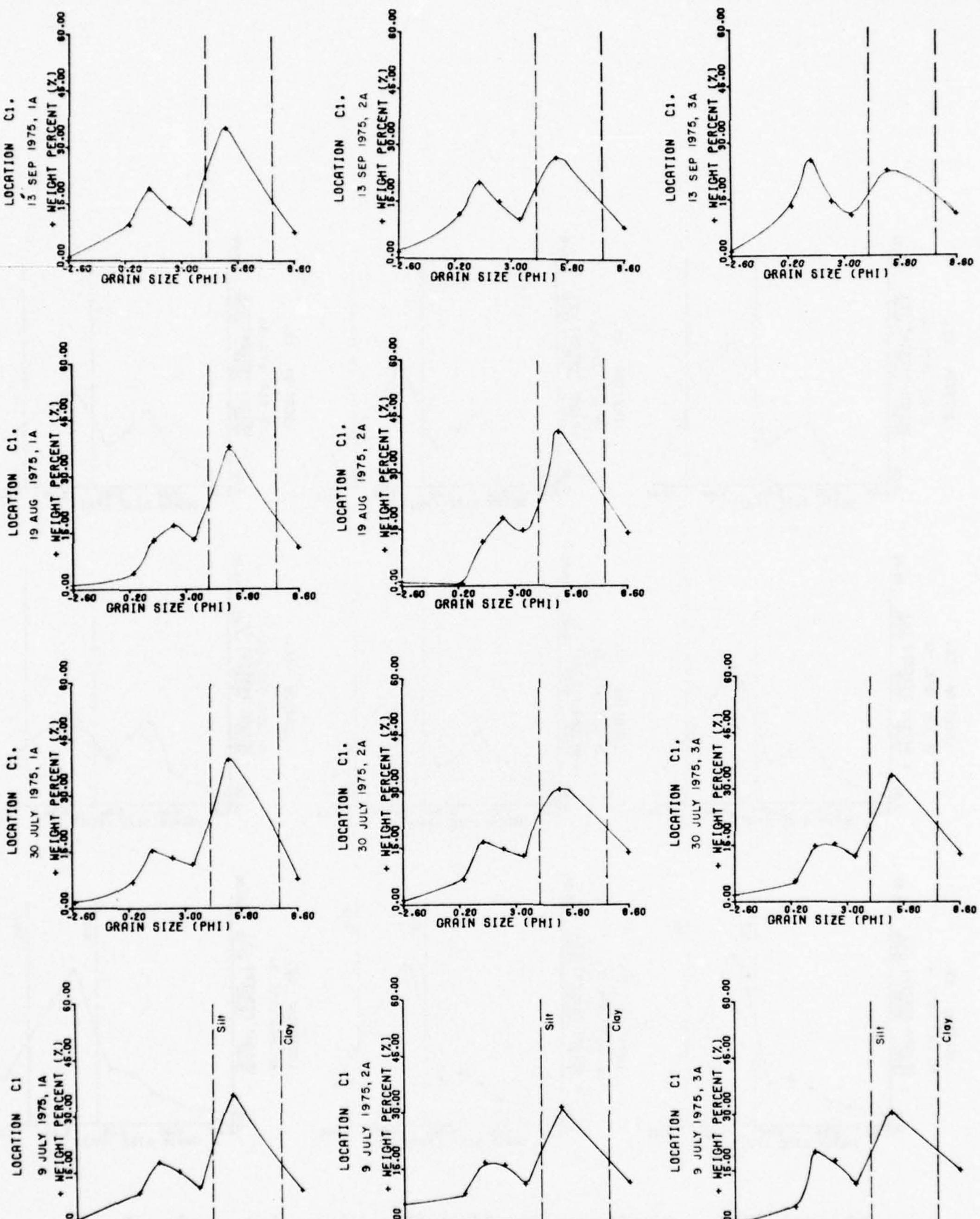


Figure U'1. Grain-size distribution determined from the mean of four replicate samples, location C1. The approximate sampling depths are 0-7 cm (1A), 7-15 cm (2A), and 15-25 cm (3A)

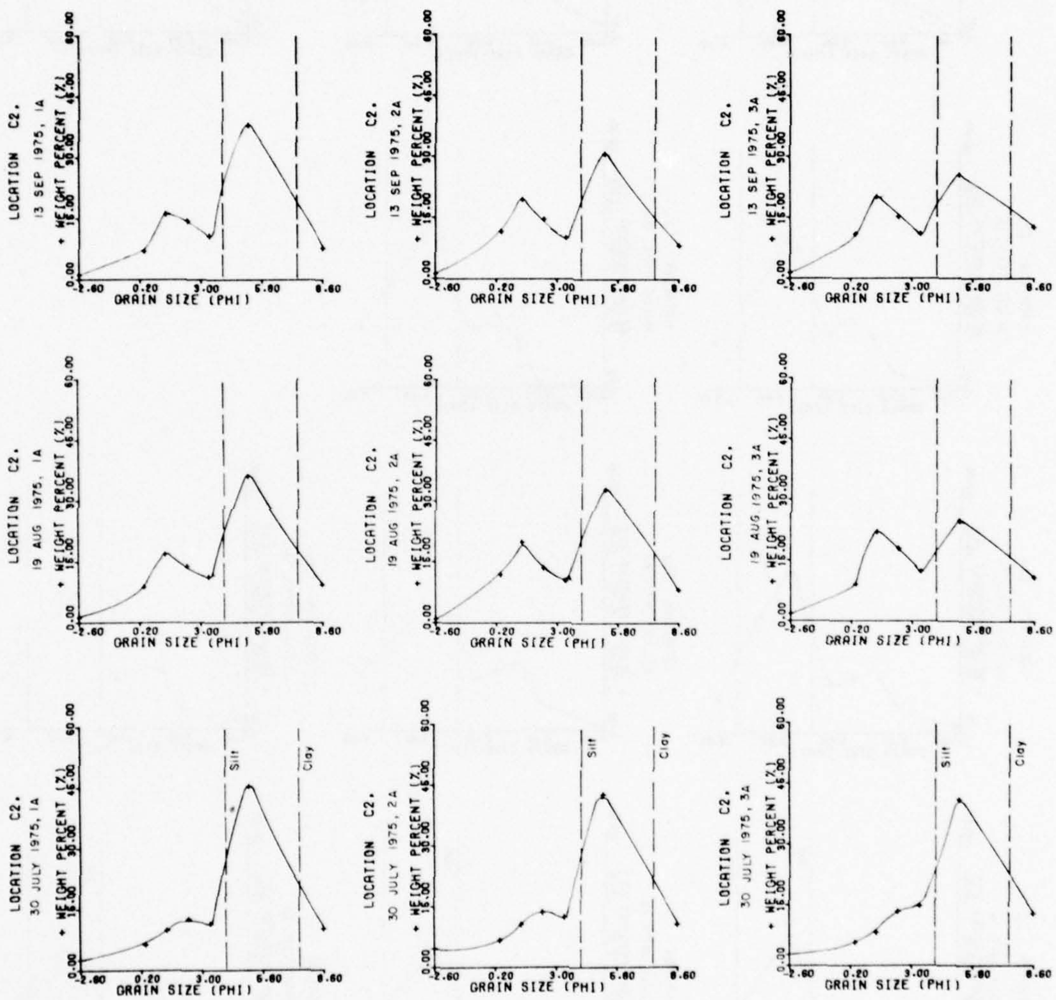


Figure U'2. Grain-size distribution determined from the mean of four replicate samples, location C2

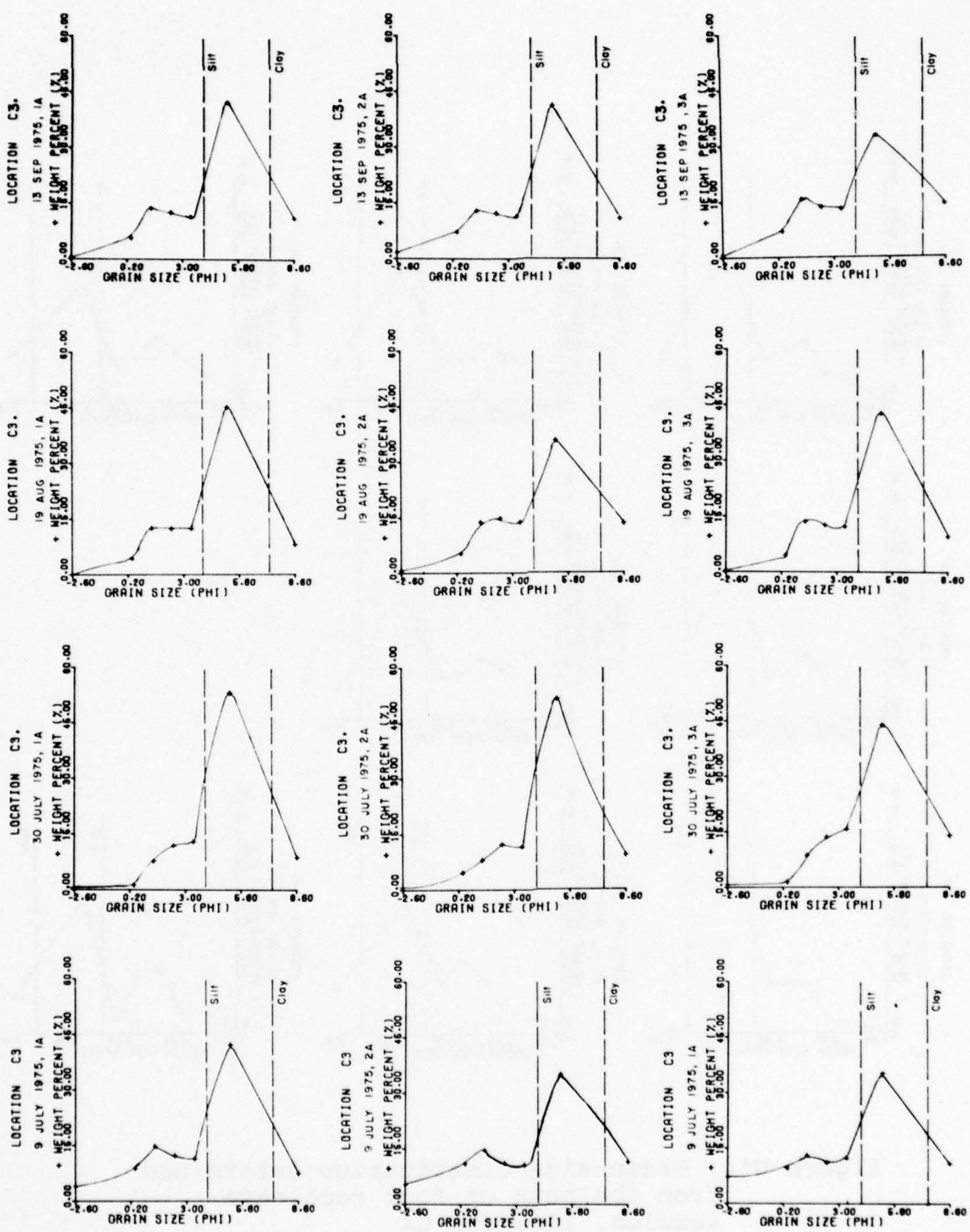


Figure U'3. Grain-size distribution determined from the mean of four replicate samples, location C3

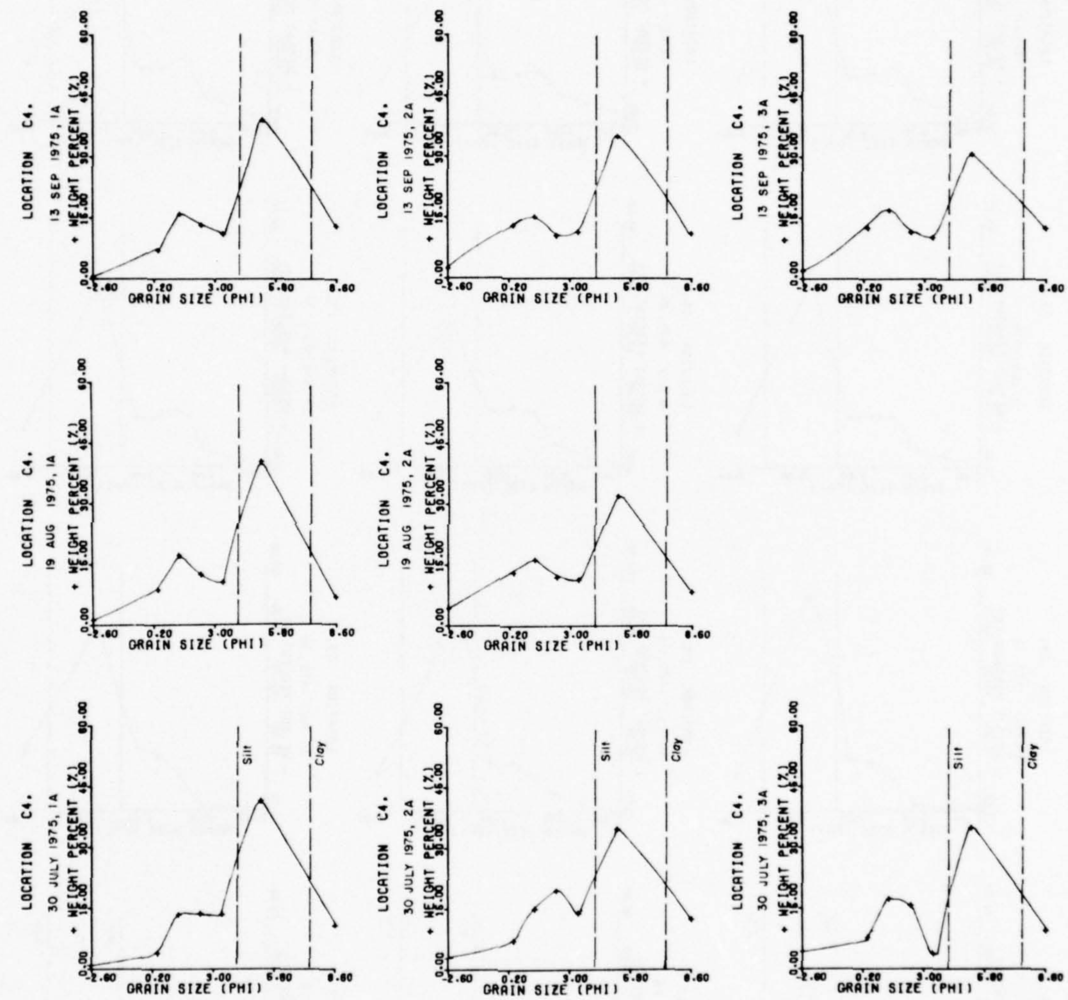


Figure U'4. Grain-size distribution determined from the mean of four replicate samples, location C4

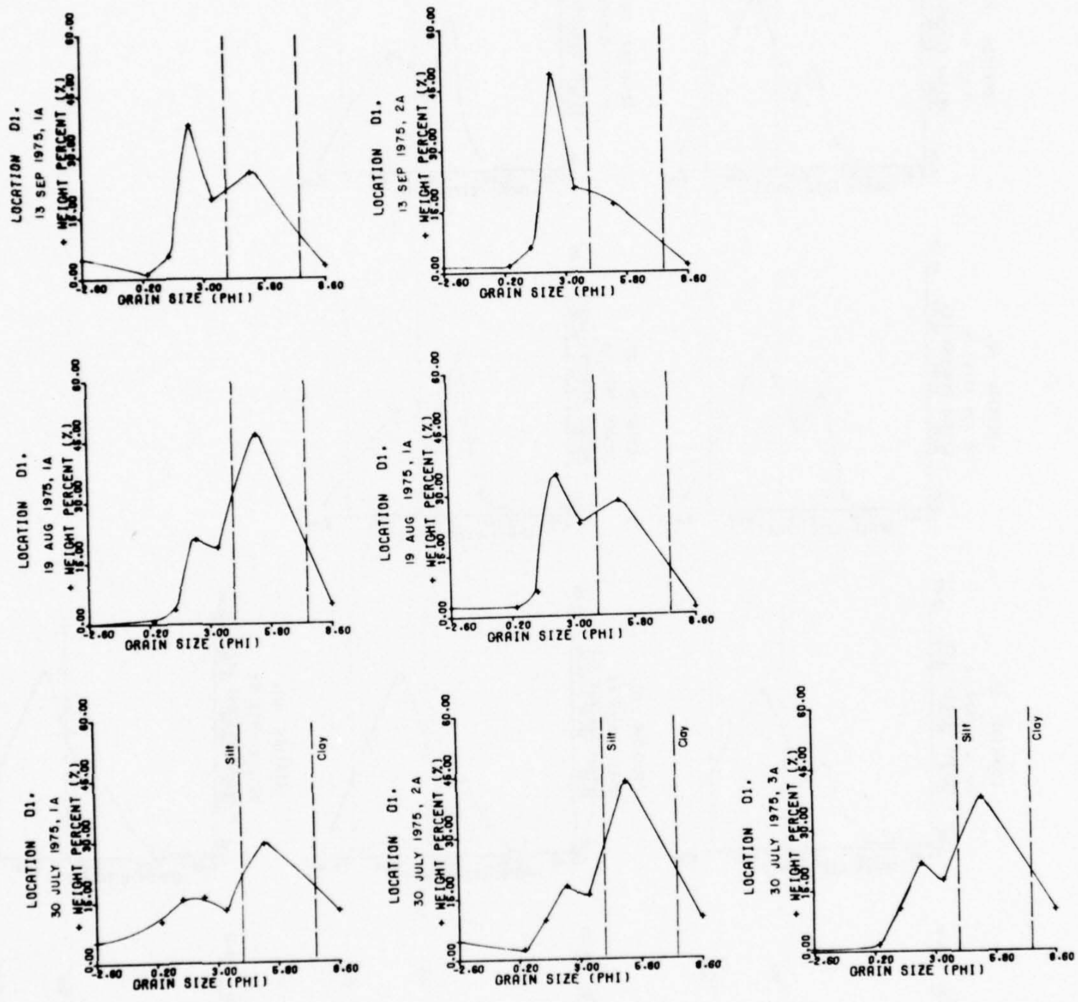


Figure U'5. Grain-size distribution determined from the mean of four replicate samples, location D1

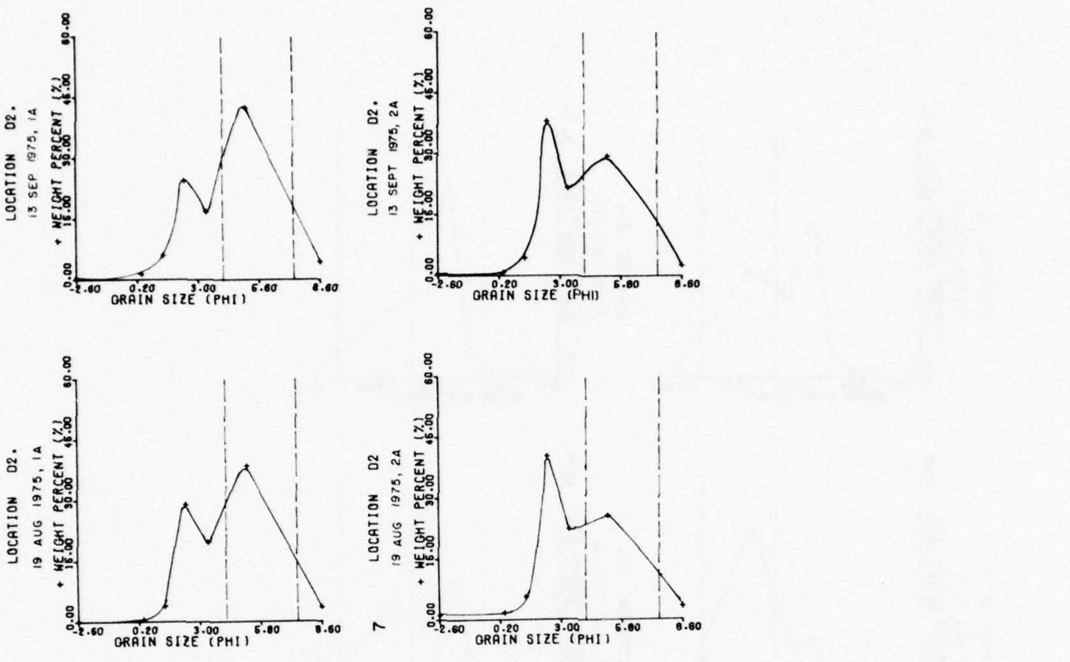


Figure U'6. Grain-size distribution determined from the mean of four replicate samples, location D2

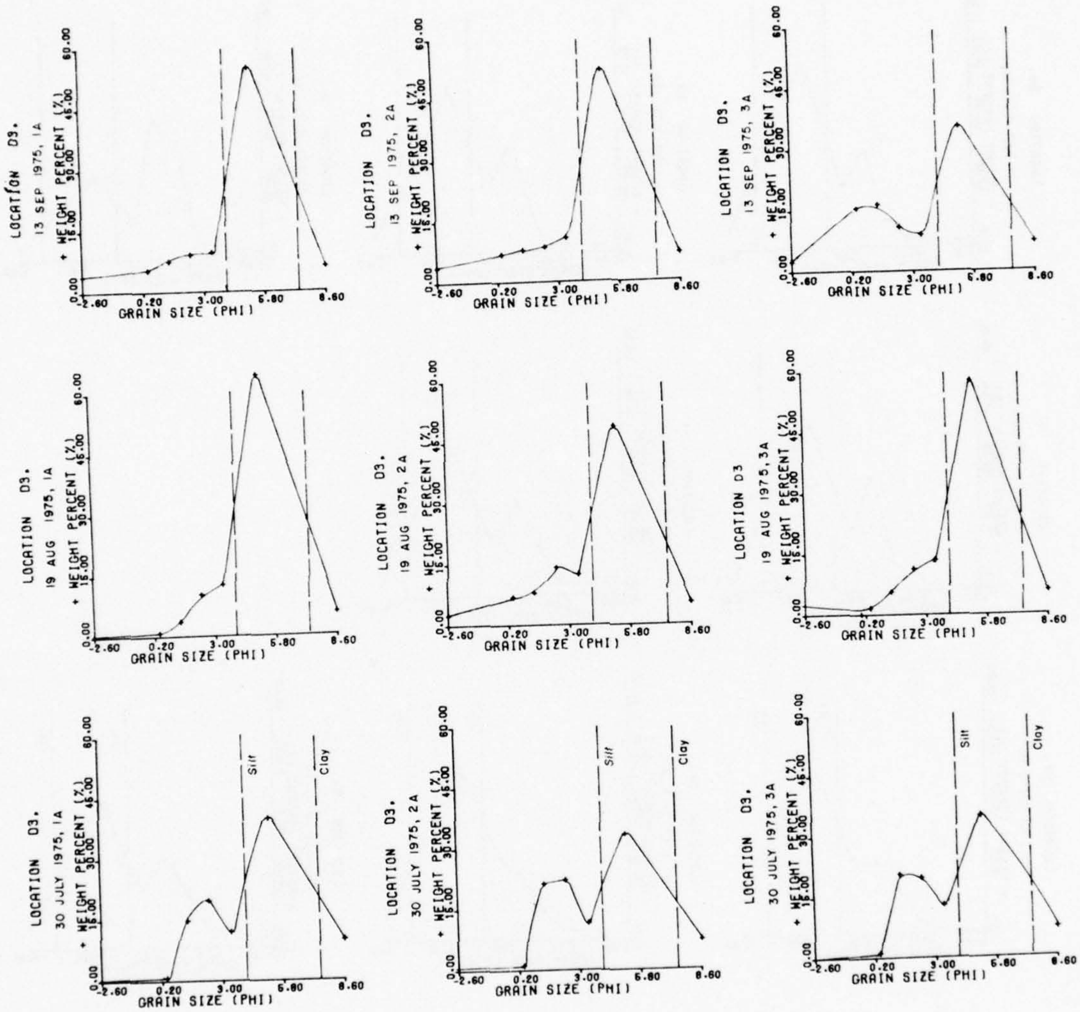


Figure U'7. Grain-size distribution determined from the mean of four replicate samples, location D3

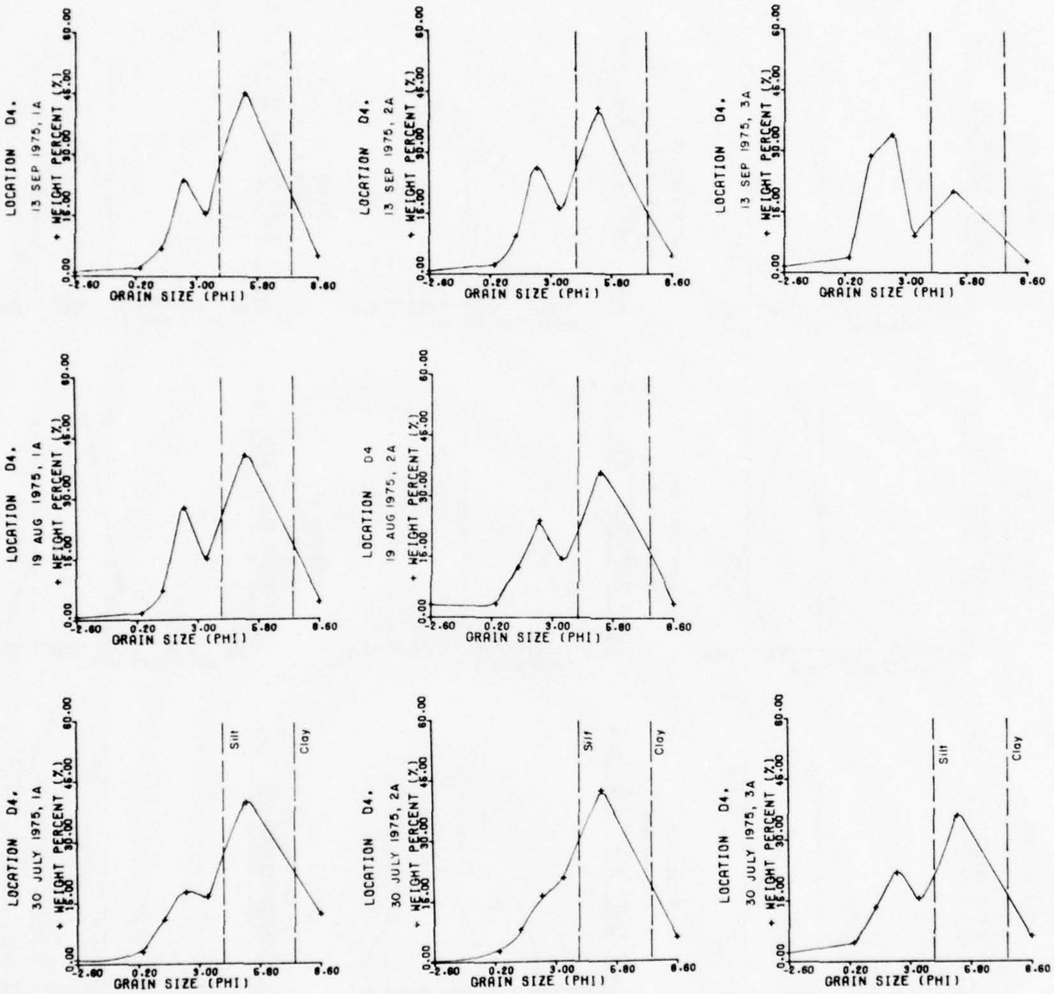


Figure U'8. Grain-size distribution determined from the mean of four replicate samples, location D4

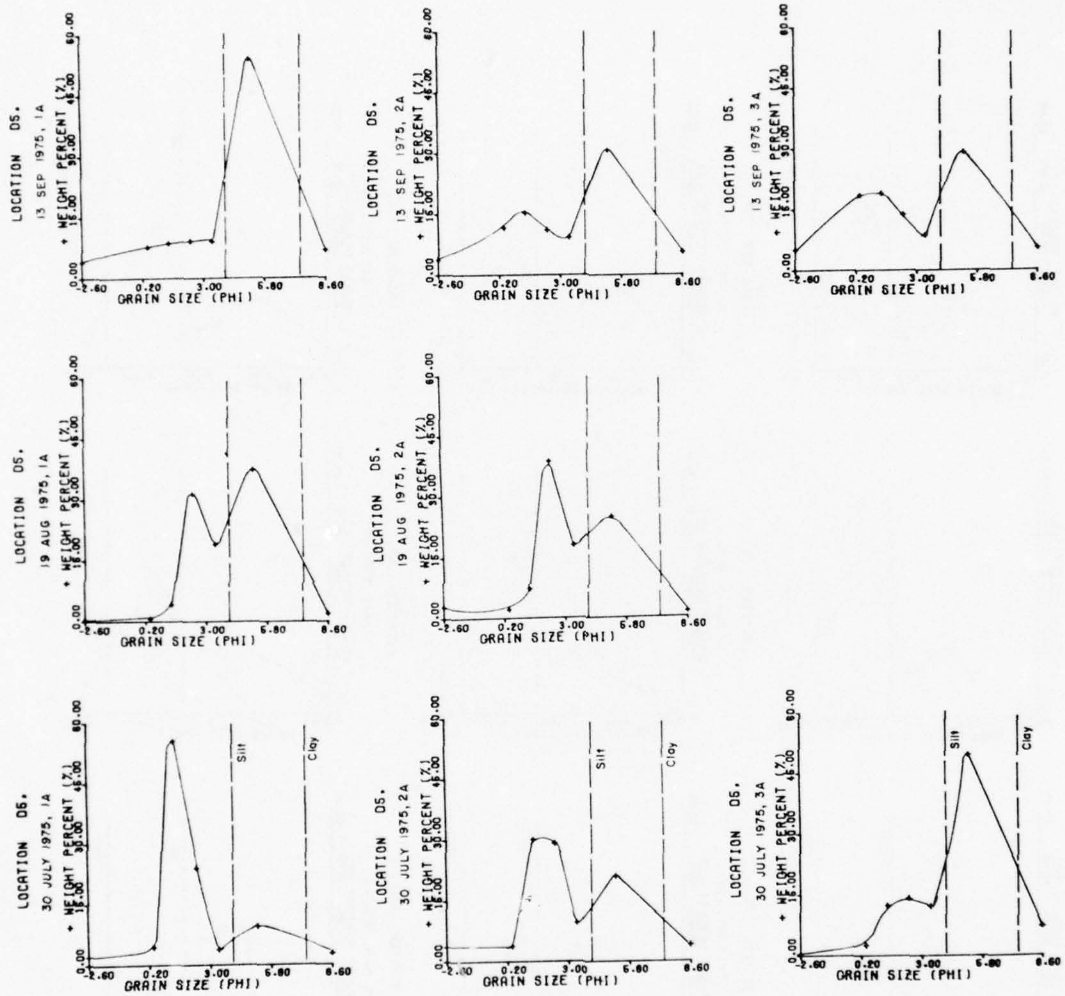


Figure U'9. Grain-size distribution determined from the mean of four replicate samples, location D5

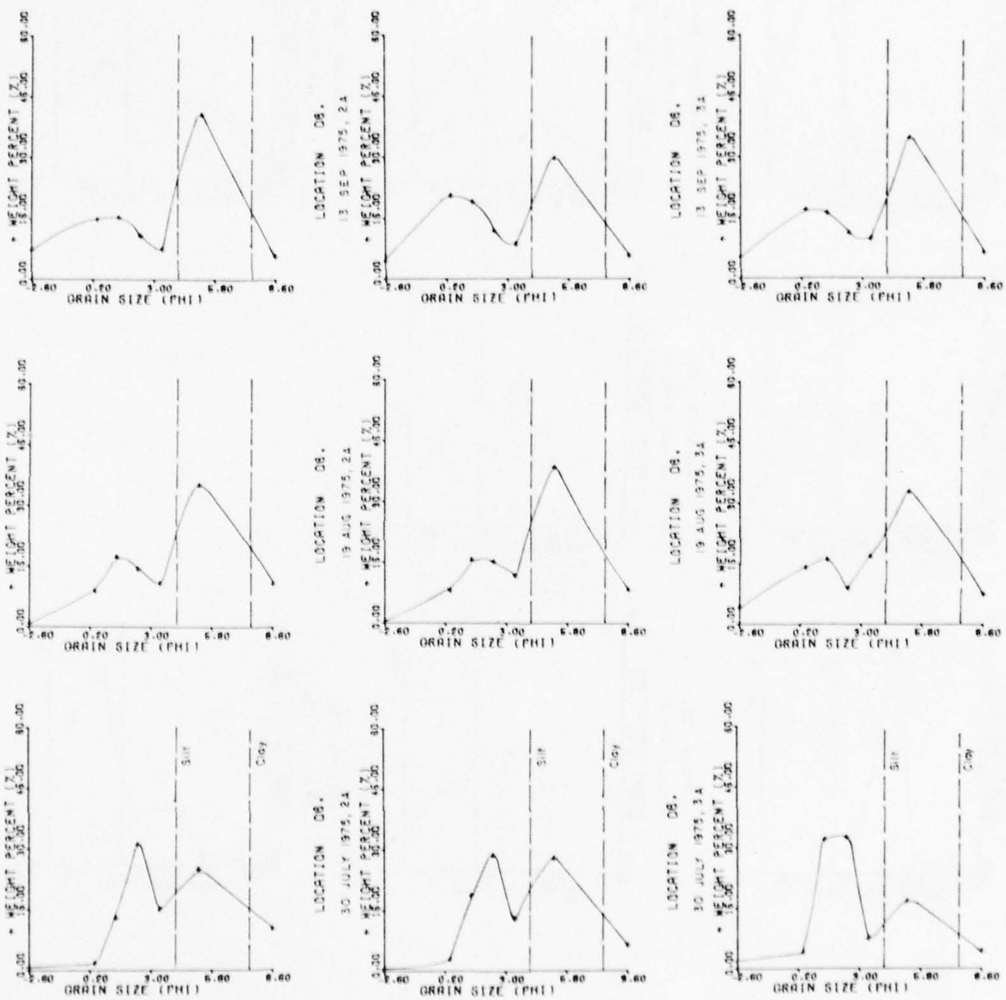


Figure U'10. Grain-size distribution determined from the mean of four replicate samples, location D6

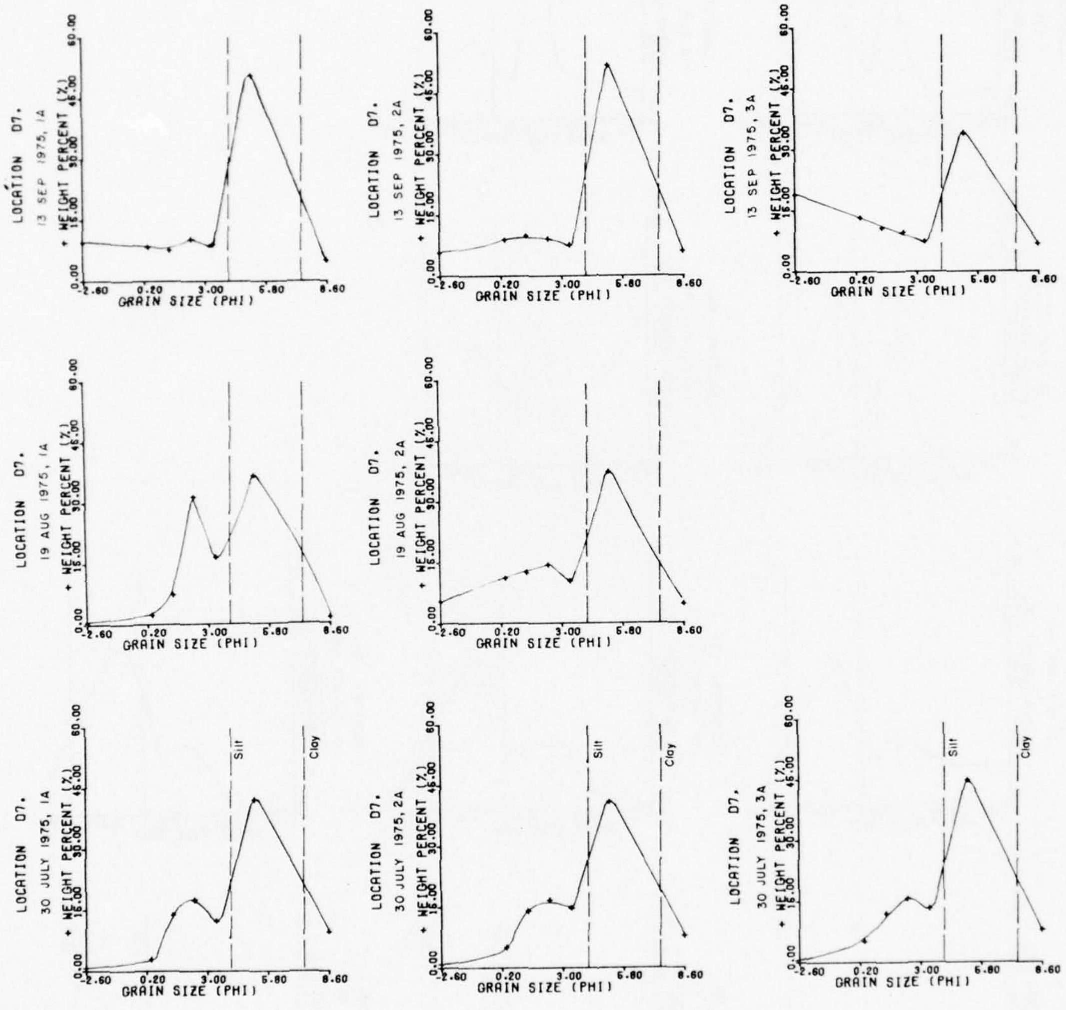


Figure U'11. Grain-size distribution determined
from the mean of four replicate
samples, location D7

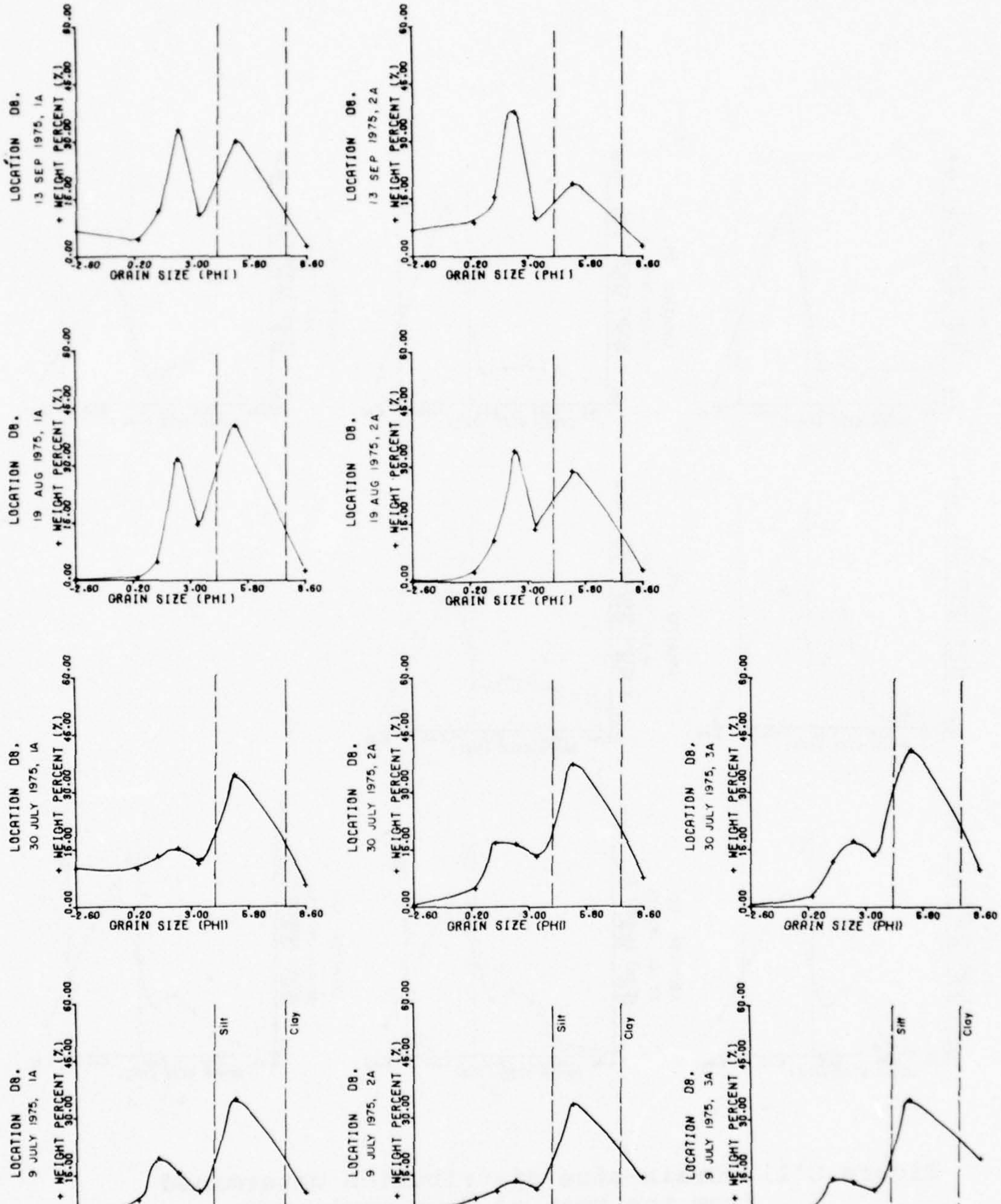


Figure U'12. Grain-size distribution determined from the mean of four replicate samples, location D8

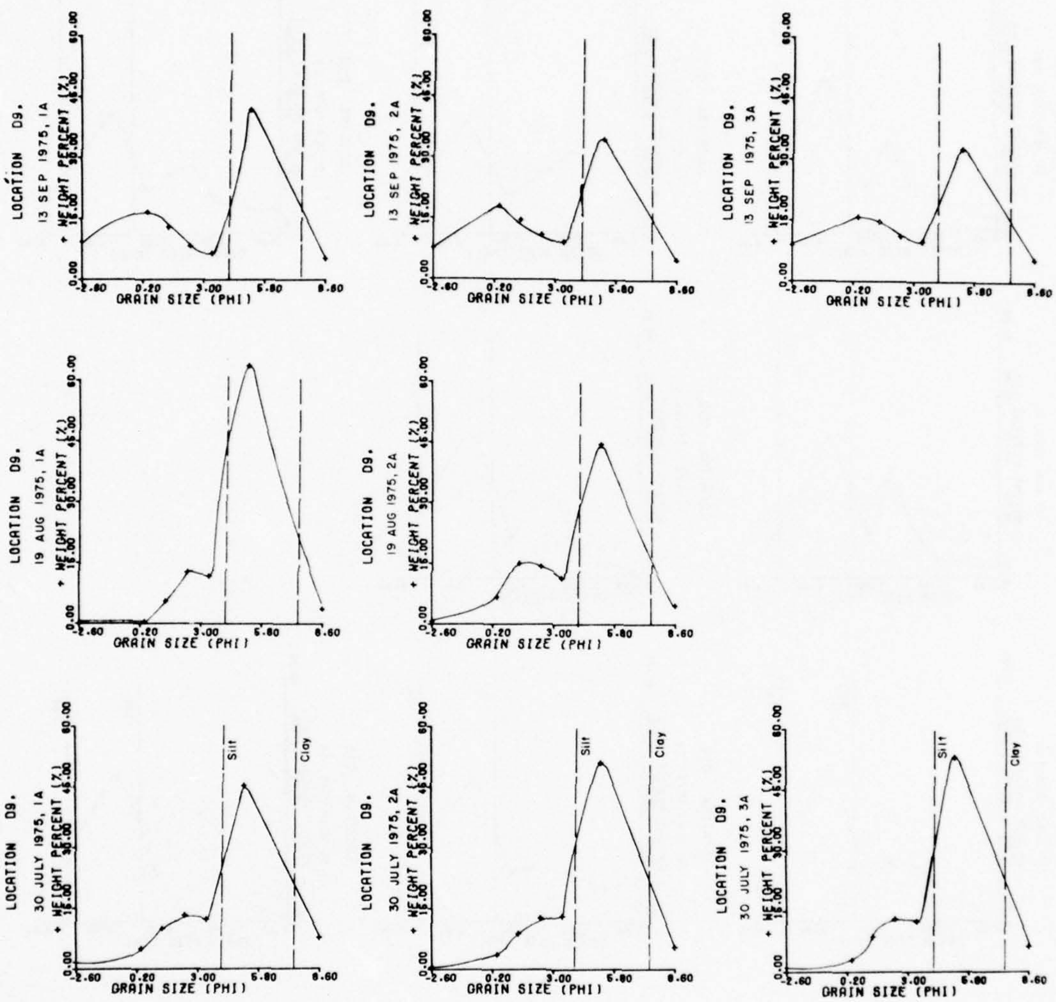


Figure U'13. Grain-size distribution determined from the mean of four replicate samples, location D9

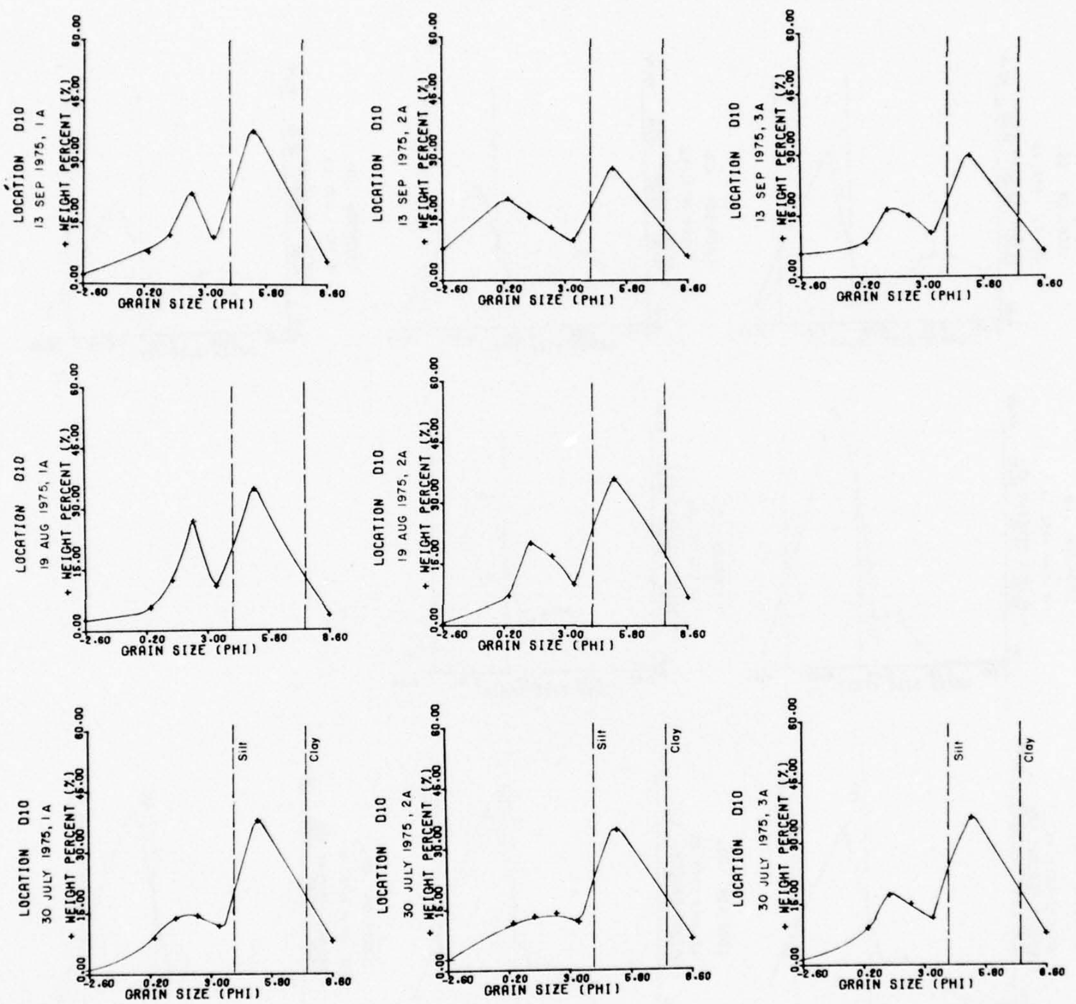


Figure U'14. Grain size distribution determined from the mean of four replicate samples, location D10

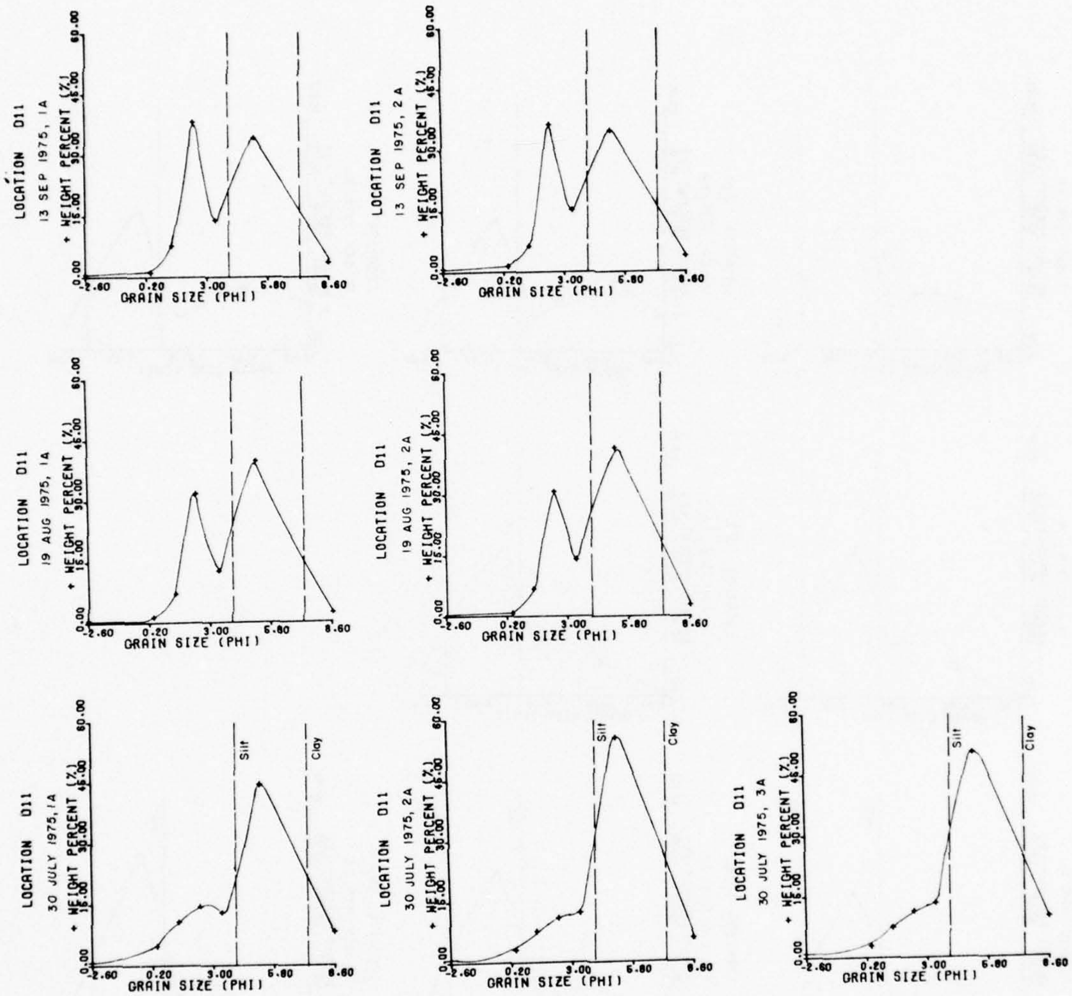


Figure U'15. Grain-size distribution determined from the mean of four replicate samples, location D11

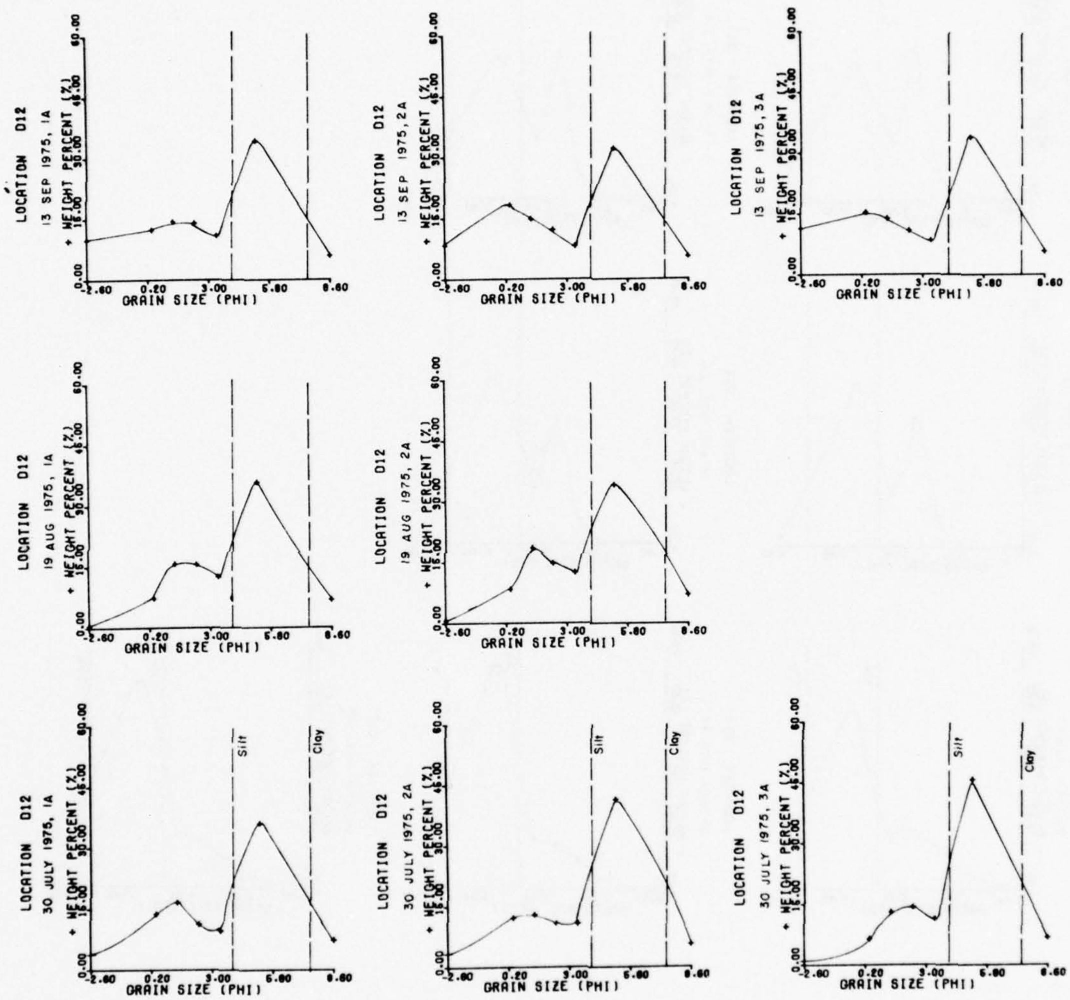


Figure U'16. Grain-size distribution determined from the mean of four replicate samples, location D12

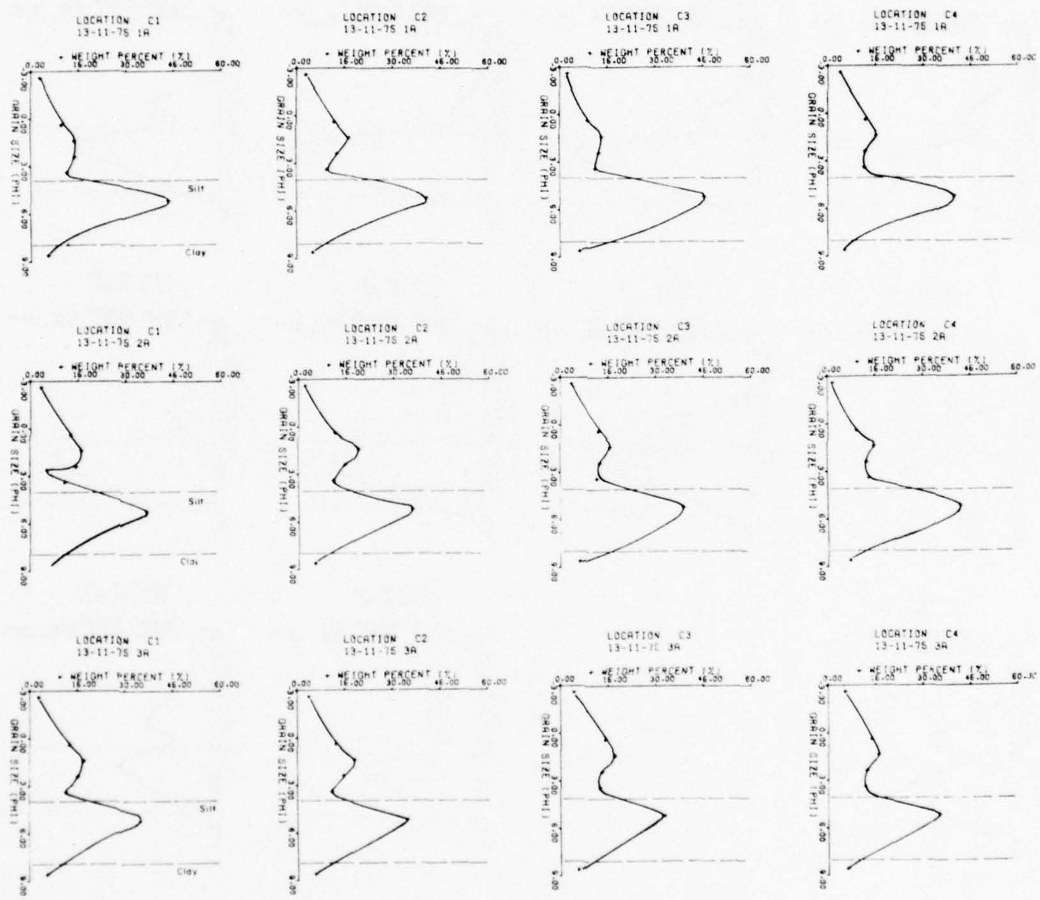


Figure U'17. Grain-size distribution determined from the mean of four replicate samples, locations C1-C4, 13 November 1975

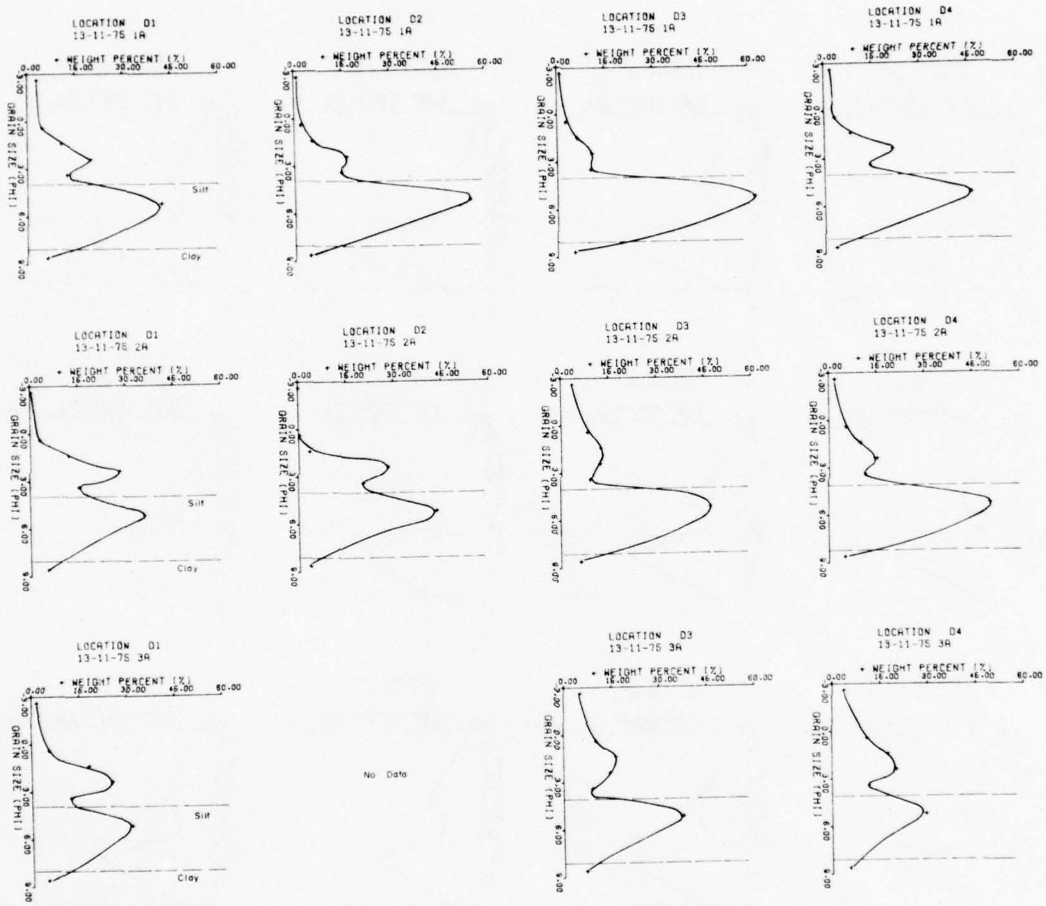


Figure U'18. Grain-size distribution determined from the mean of four replicate samples, locations D1-D4, 13 November 1975

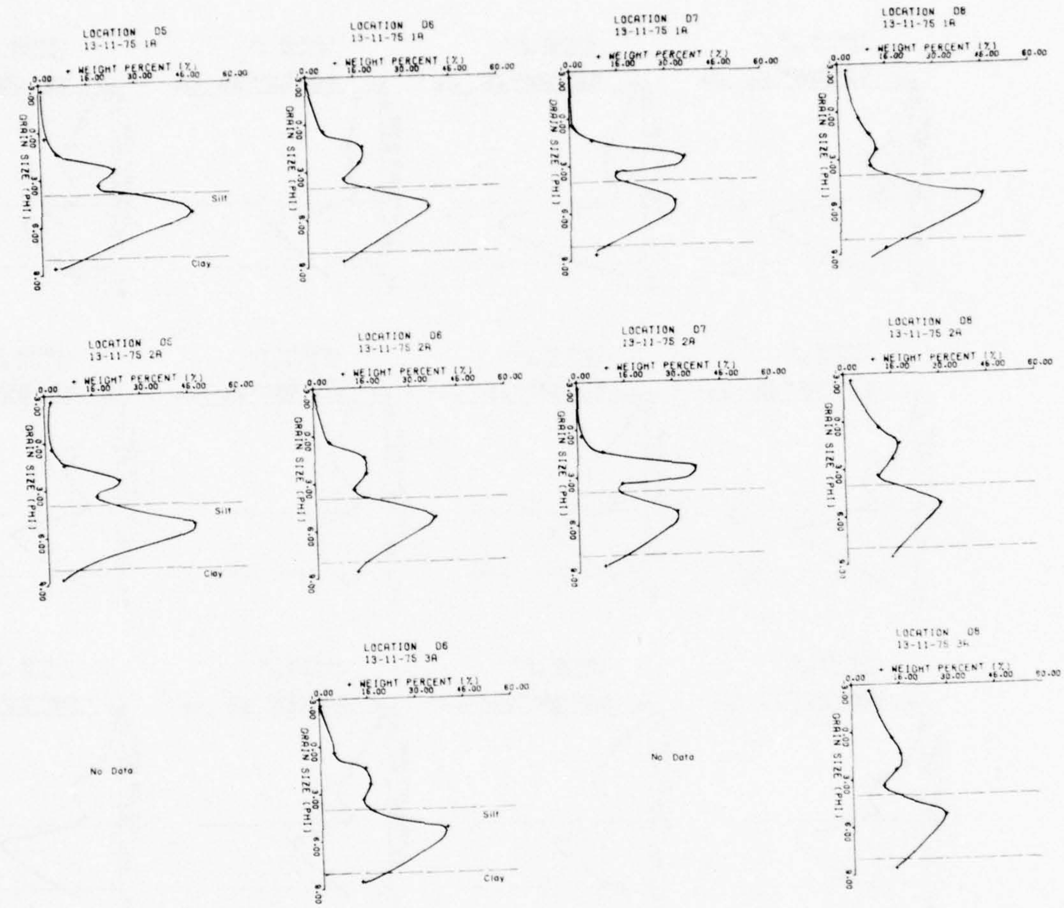


Figure U'19. Grain-size distribution determined from the mean of four replicate samples, locations D5-D8, 13 November 1975

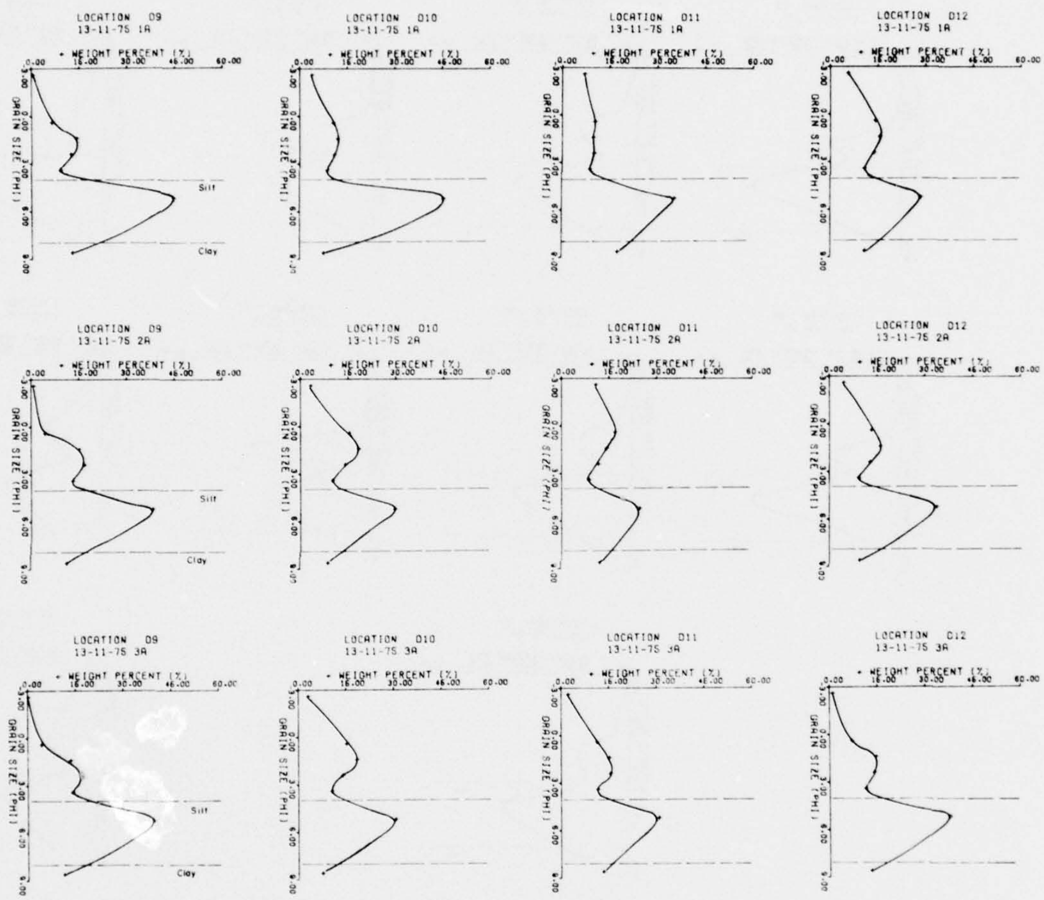


Figure U'20. Grain-size distribution determined from the mean of four replicate samples, locations D9-D12, 13 November 1975

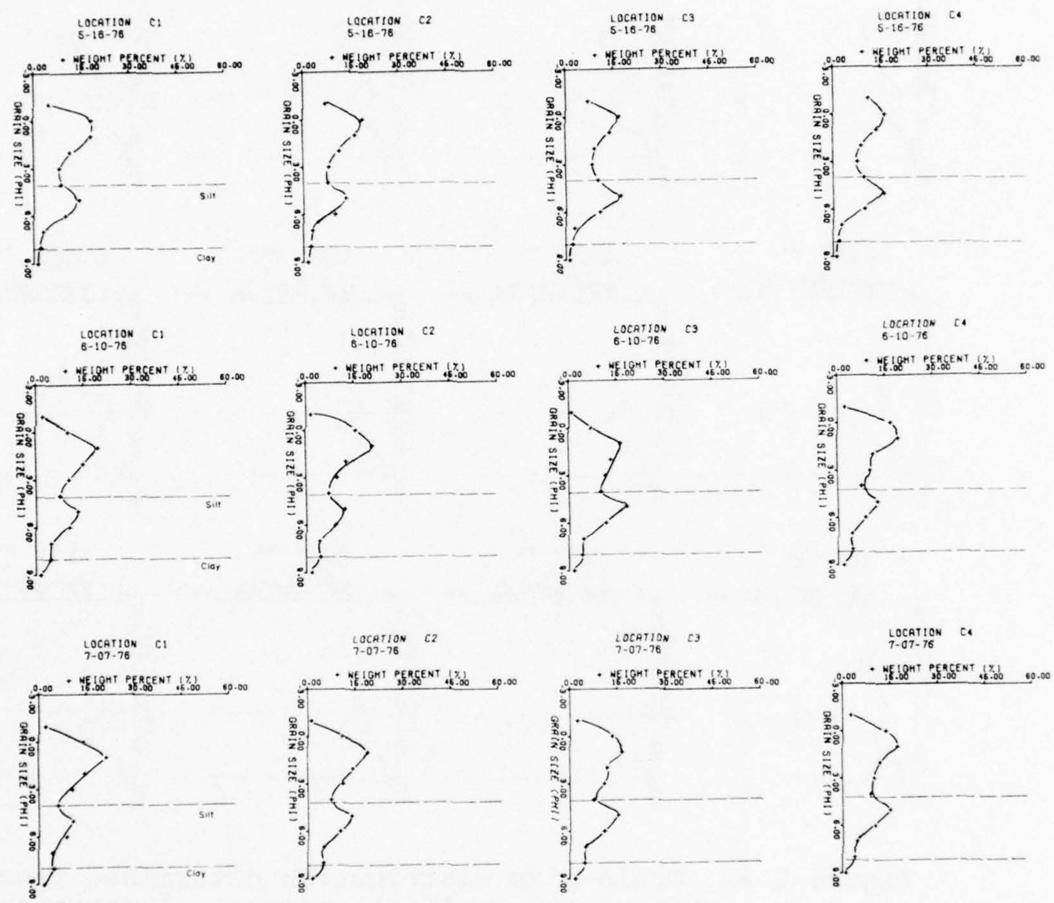


Figure U'21. Grain-size distribution determined from the mean of two replicate samples, locations C1-C4

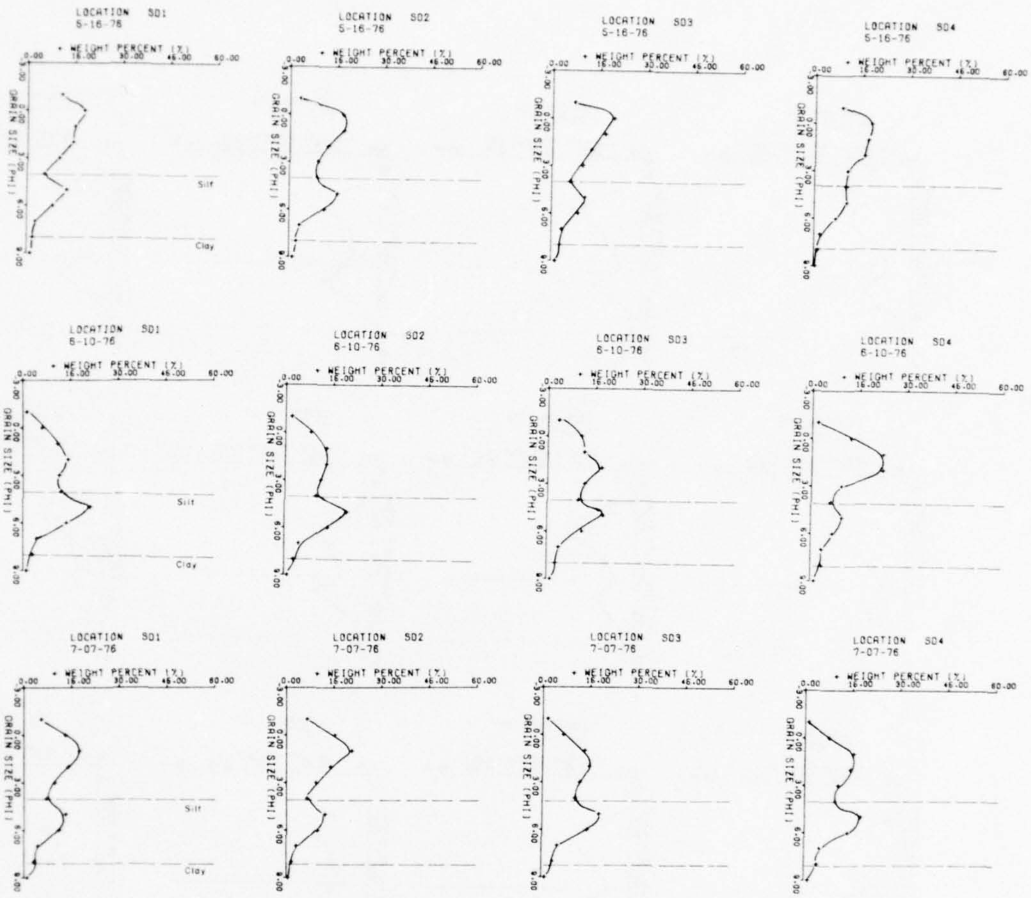


Figure U'22. Grain-size distribution determined from the mean of two replicate samples, locations 1-4

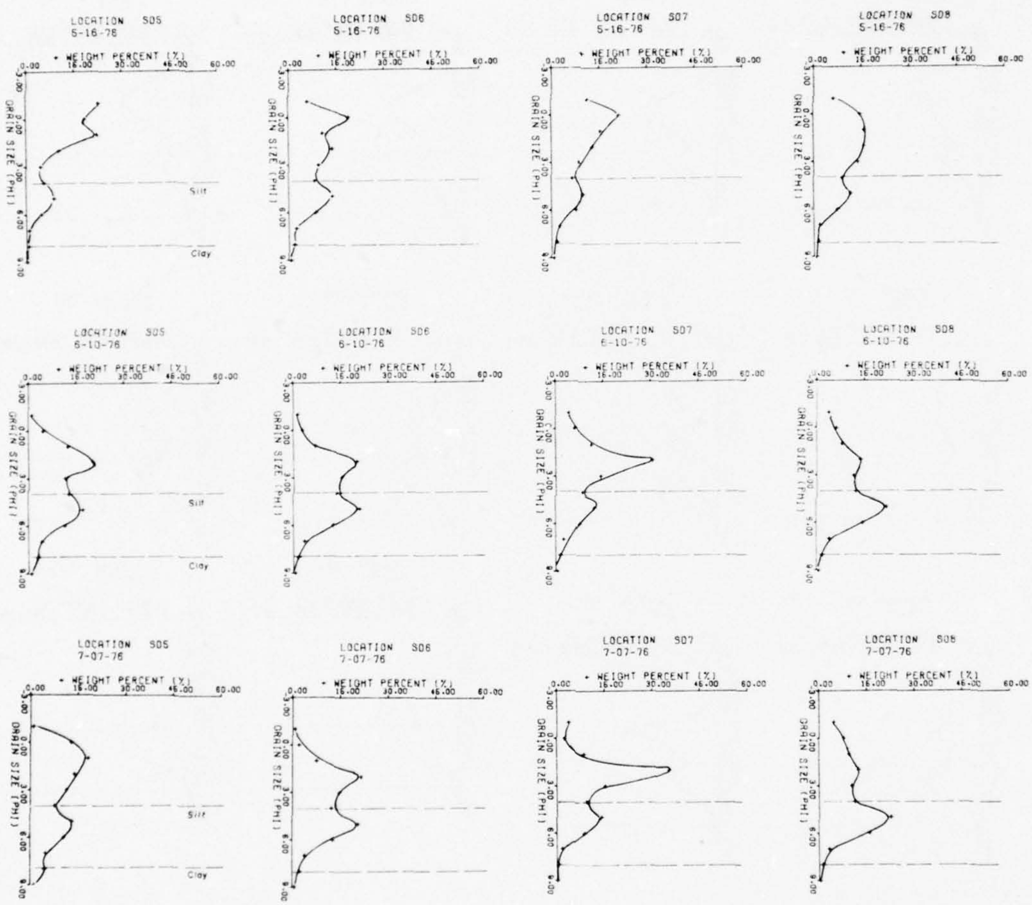


Figure U'23. Grain-size distribution determined from the mean of two replicate samples, locations 5-8

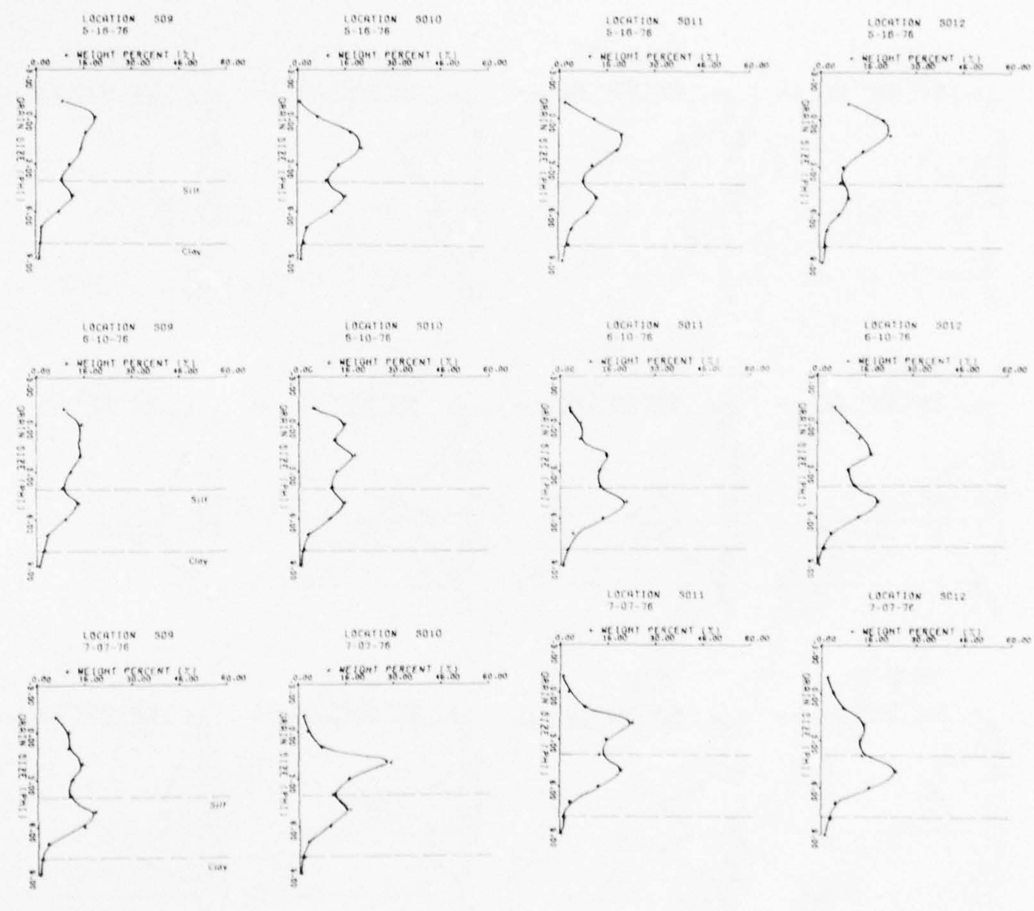


Figure U'24. Grain-size distribution determined from the mean of two replicate samples, locations 9-12

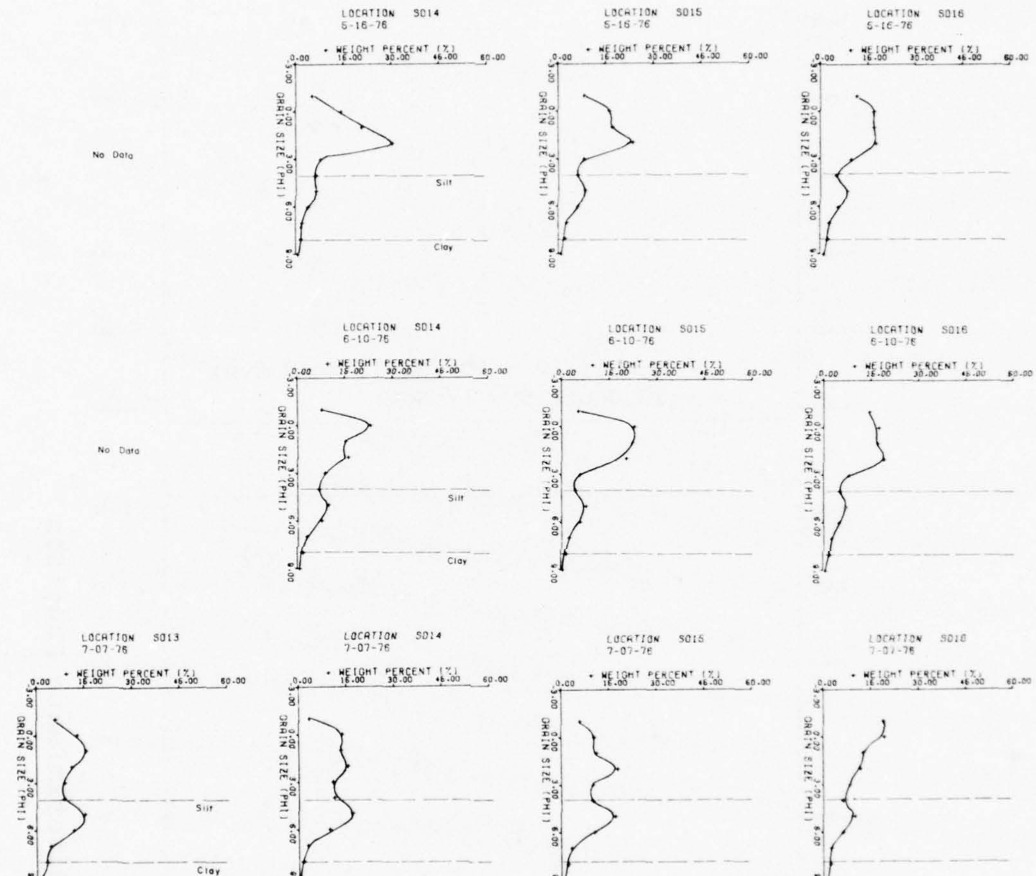


Figure U'25. Grain-size distribution determined from the mean of two replicate samples, locations 14-16

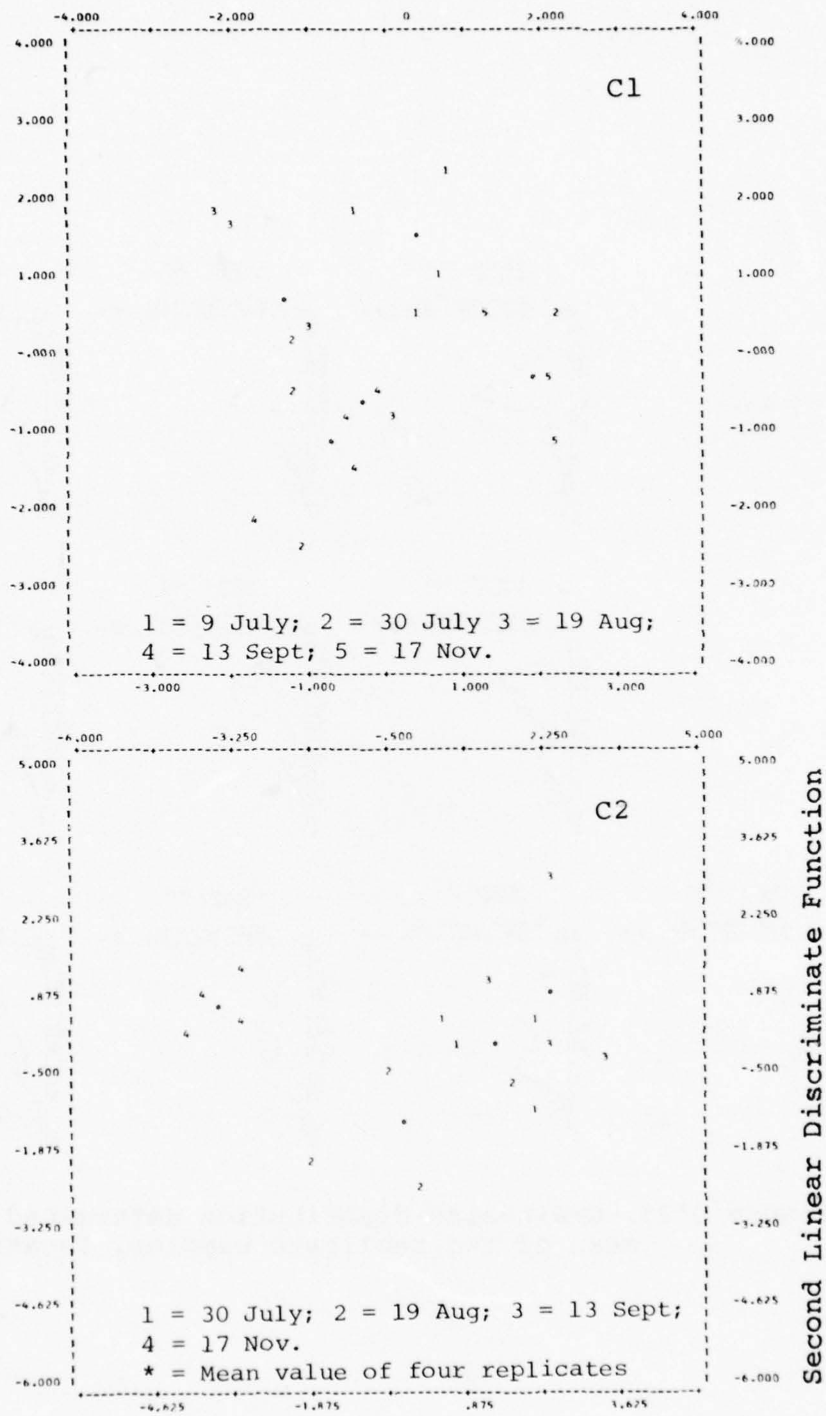


Figure U'26. Linear discriminate function plots for sand, silt, and clay on control locations C1 and C2. The numbers correspond to the sampling dates in 1975

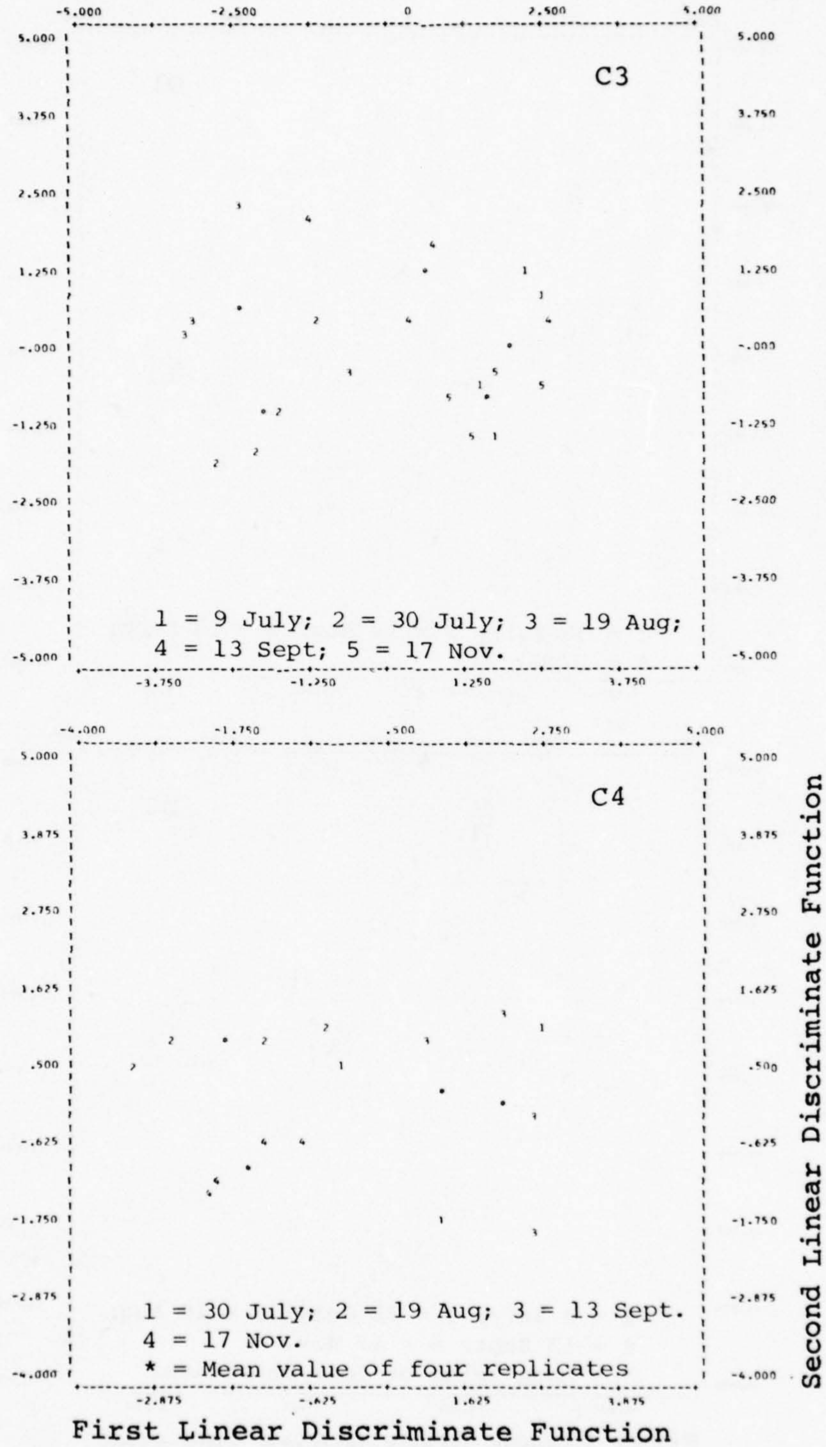


Figure U'27. Linear discriminate function plots for sand, silt, and clay on control locations C3 and C4. The numbers correspond to the sampling dates in 1975

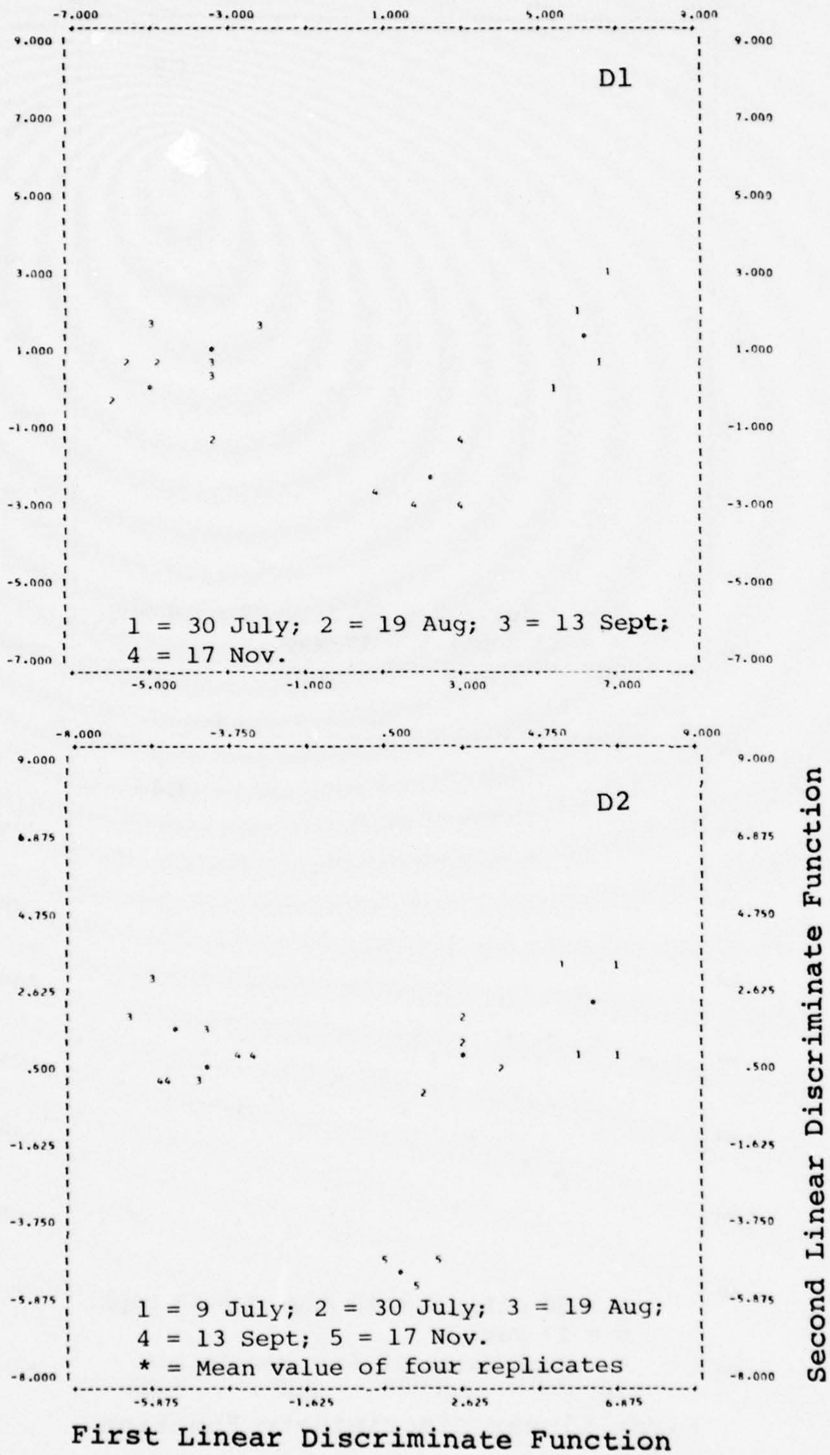


Figure U'28. Linear discriminate function plots for sand, silt, and clay on control locations D1 and D2. The numbers correspond to the sampling dates in 1975

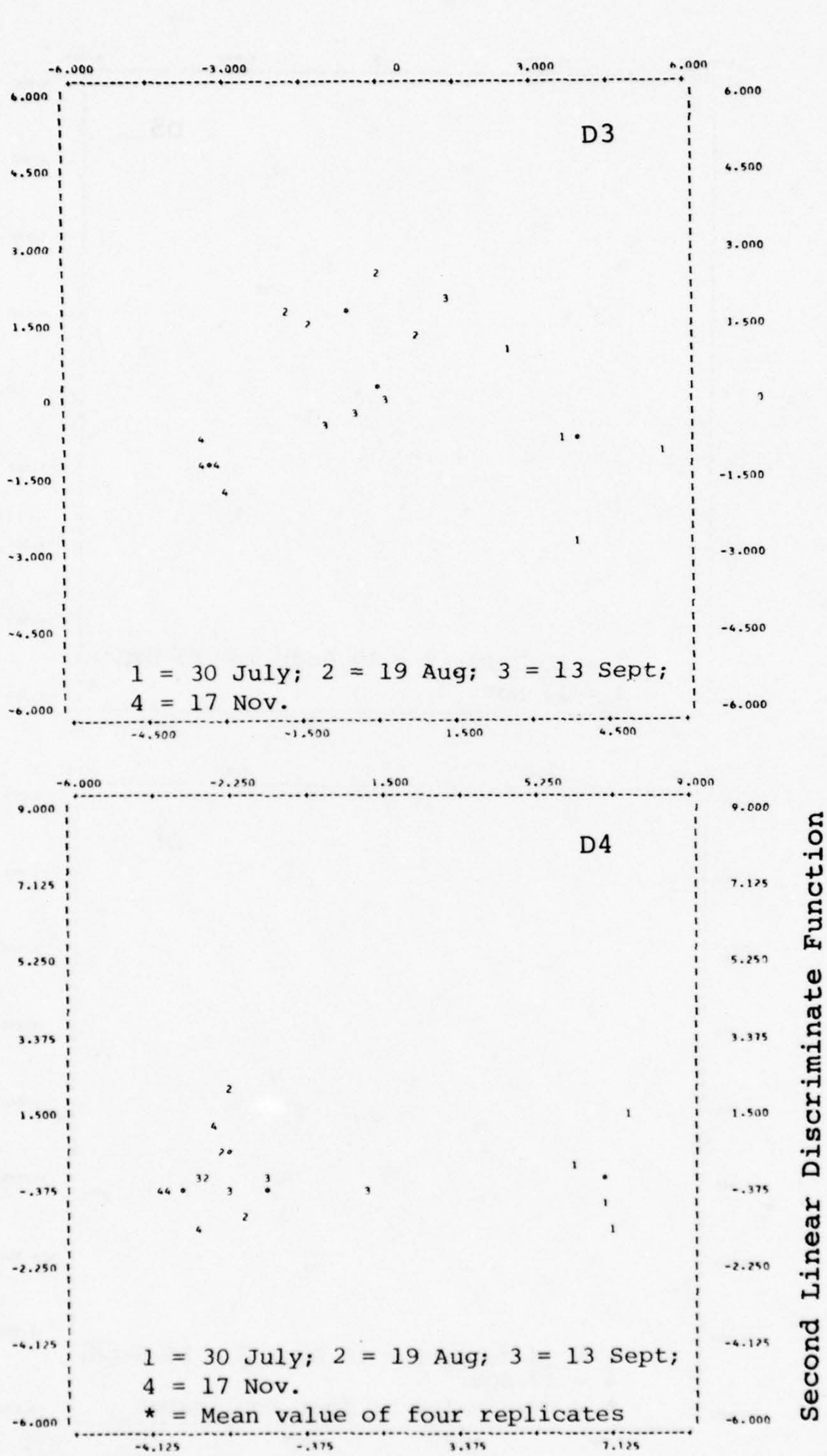


Figure U'29. Linear discriminate function plots for sand, silt, and clay on control locations D3 and D4. The numbers correspond to the sampling dates in 1975

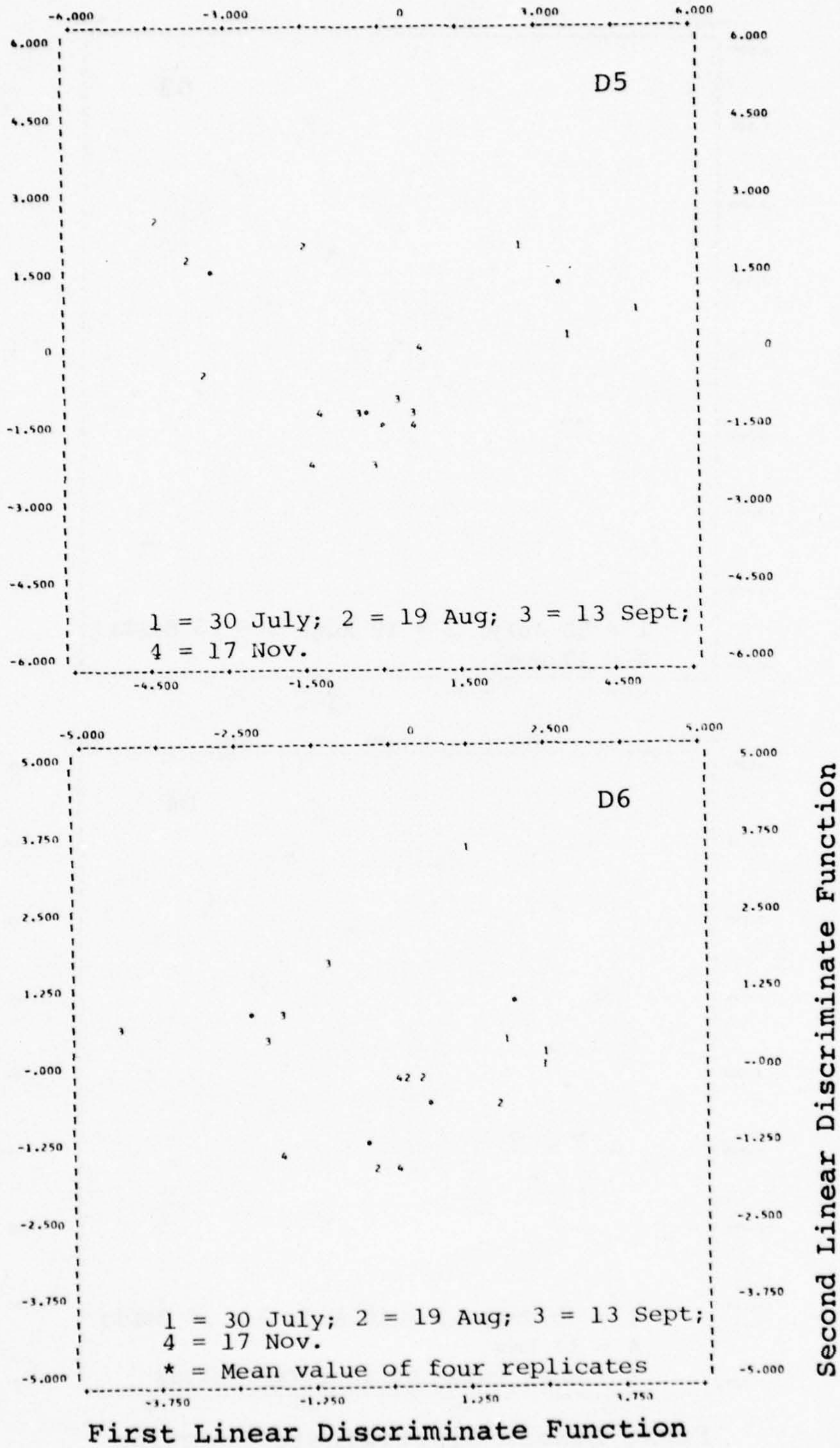


Figure U'30. Linear discriminate function plots for sand, silt, and clay on control locations D5 and D6. The numbers correspond to the sampling dates in 1975

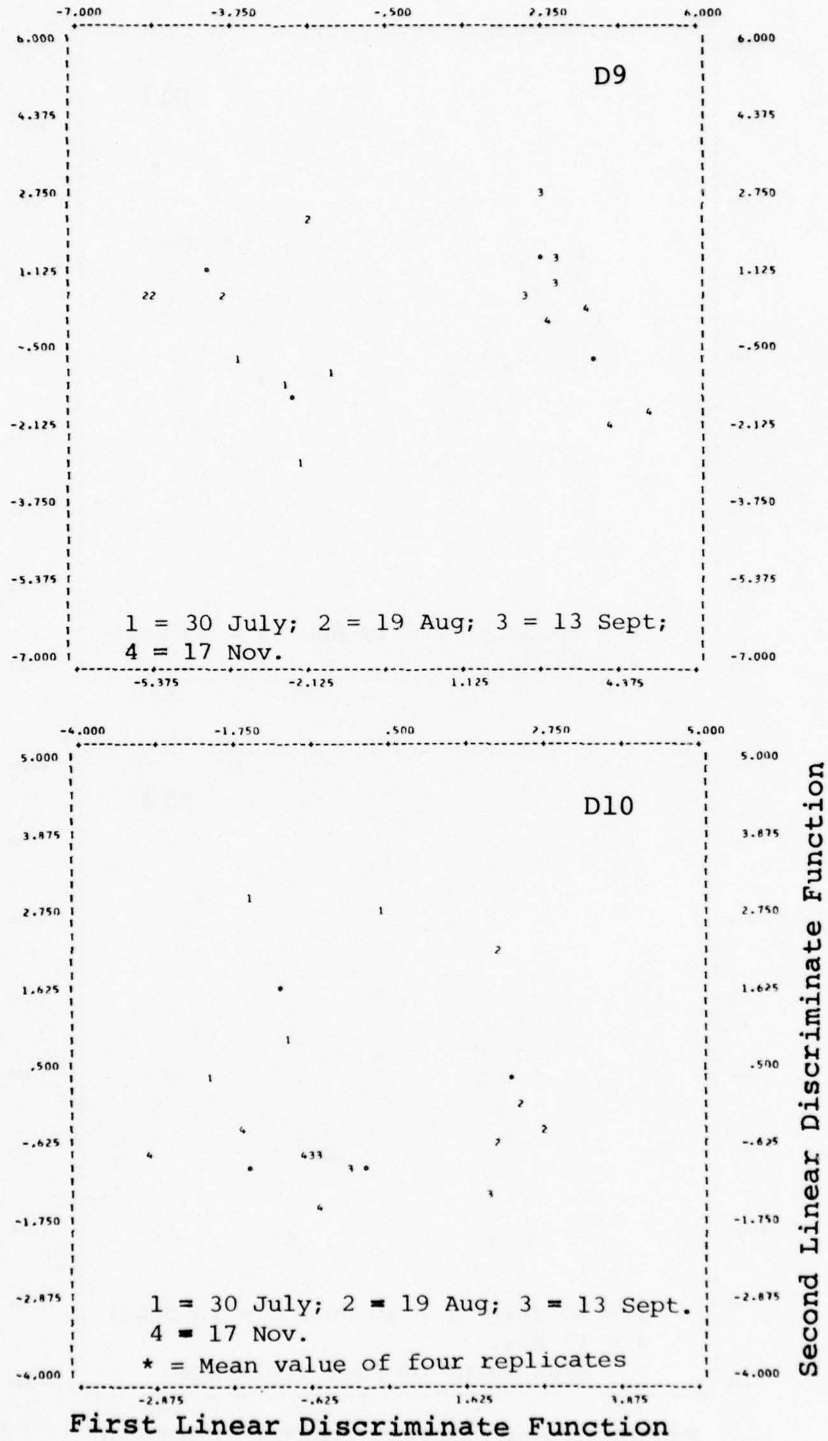


Figure U'31. Linear discriminate function plots for sand, silt, and clay on control locations D9 and D10. The numbers correspond to the sampling dates in 1975

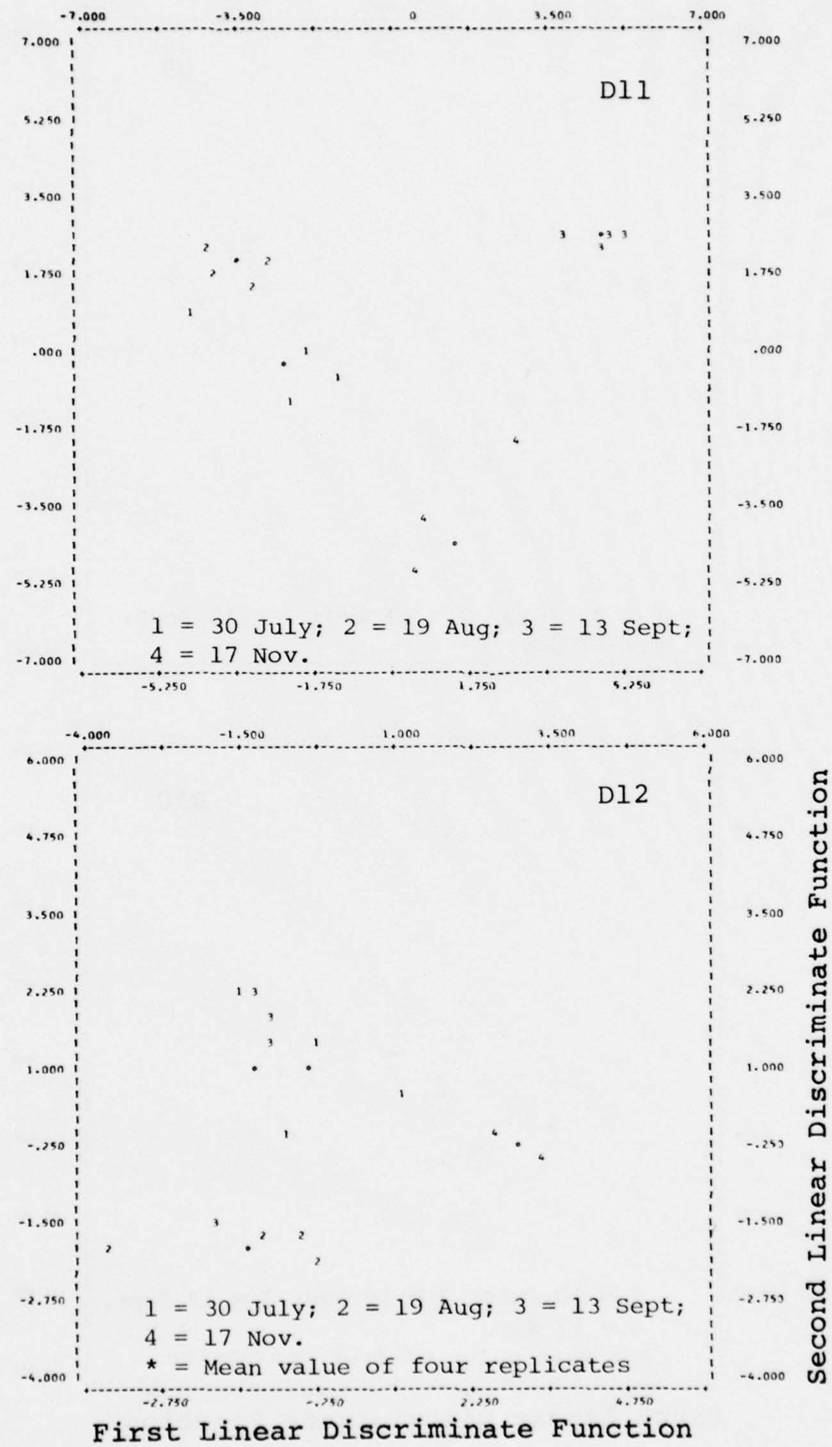


Figure U'32. Linear discriminate function plots for sand, silt, and clay on control locations D11 and D12. The numbers correspond to the sampling dates in 1975

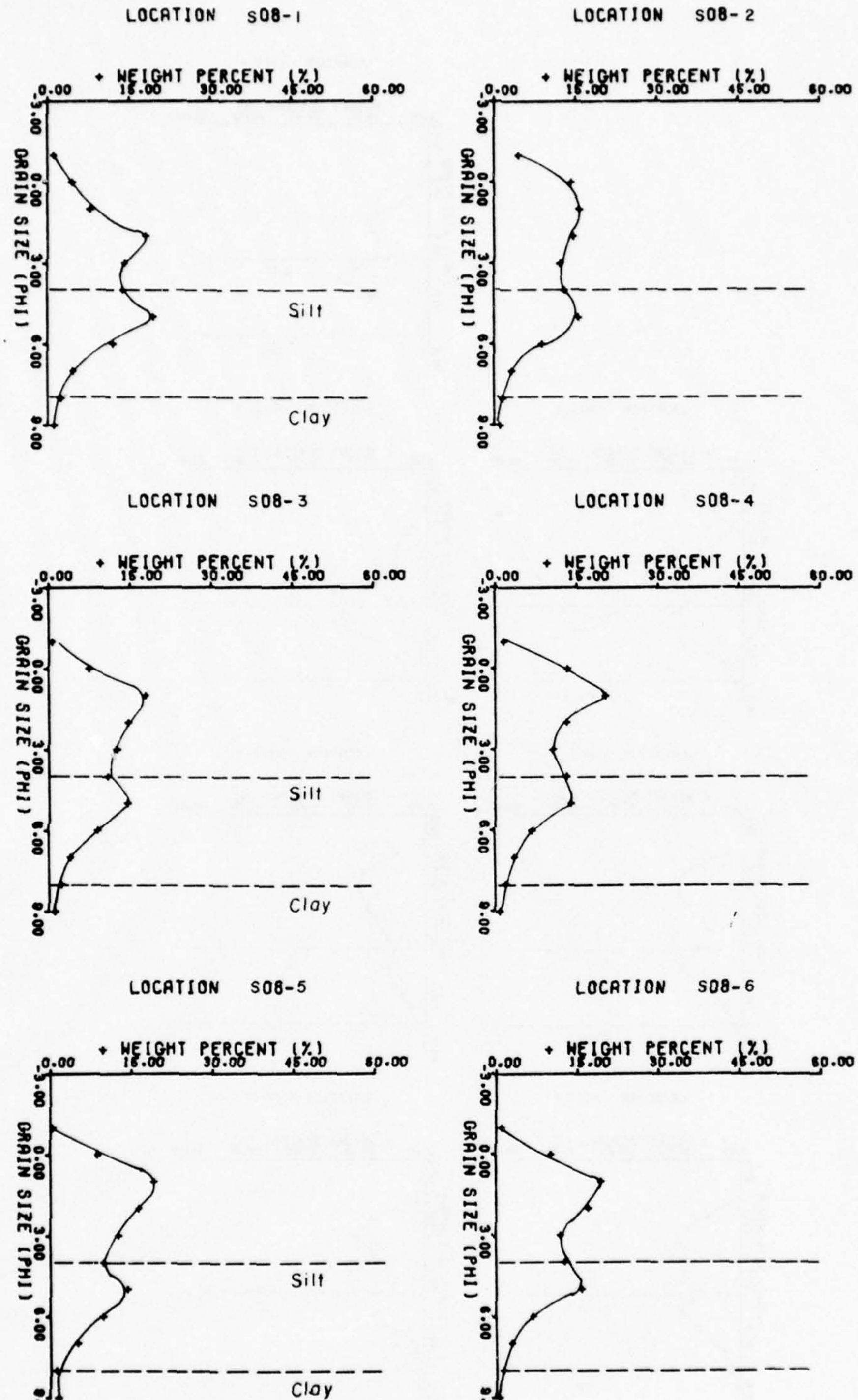


Figure U'33. Distribution of sediments in a sediment core collected on 8 June 1976 at station 8 Sampling interval with depth is 2.5 cm, total depth is 24.6 cm

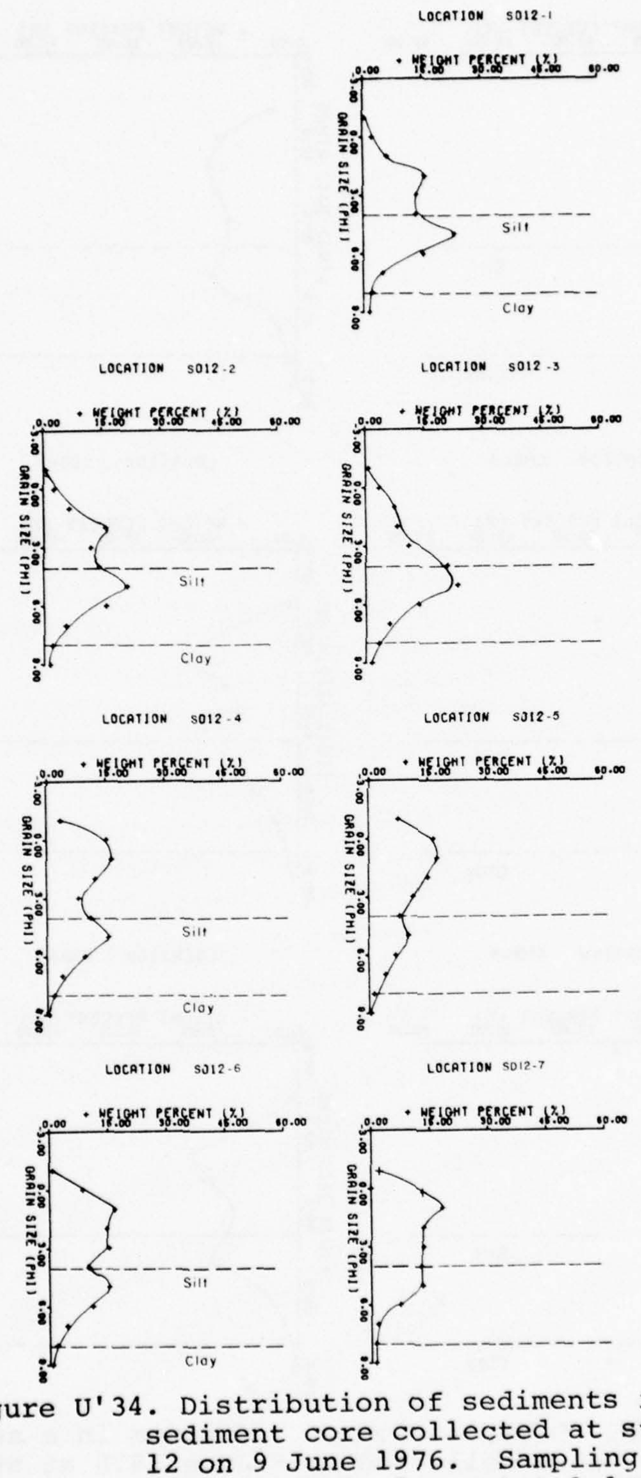


Figure U'34. Distribution of sediments in a sediment core collected at station 12 on 9 June 1976. Sampling interval with depth is 5 cm, total length is 50 cm (continued)

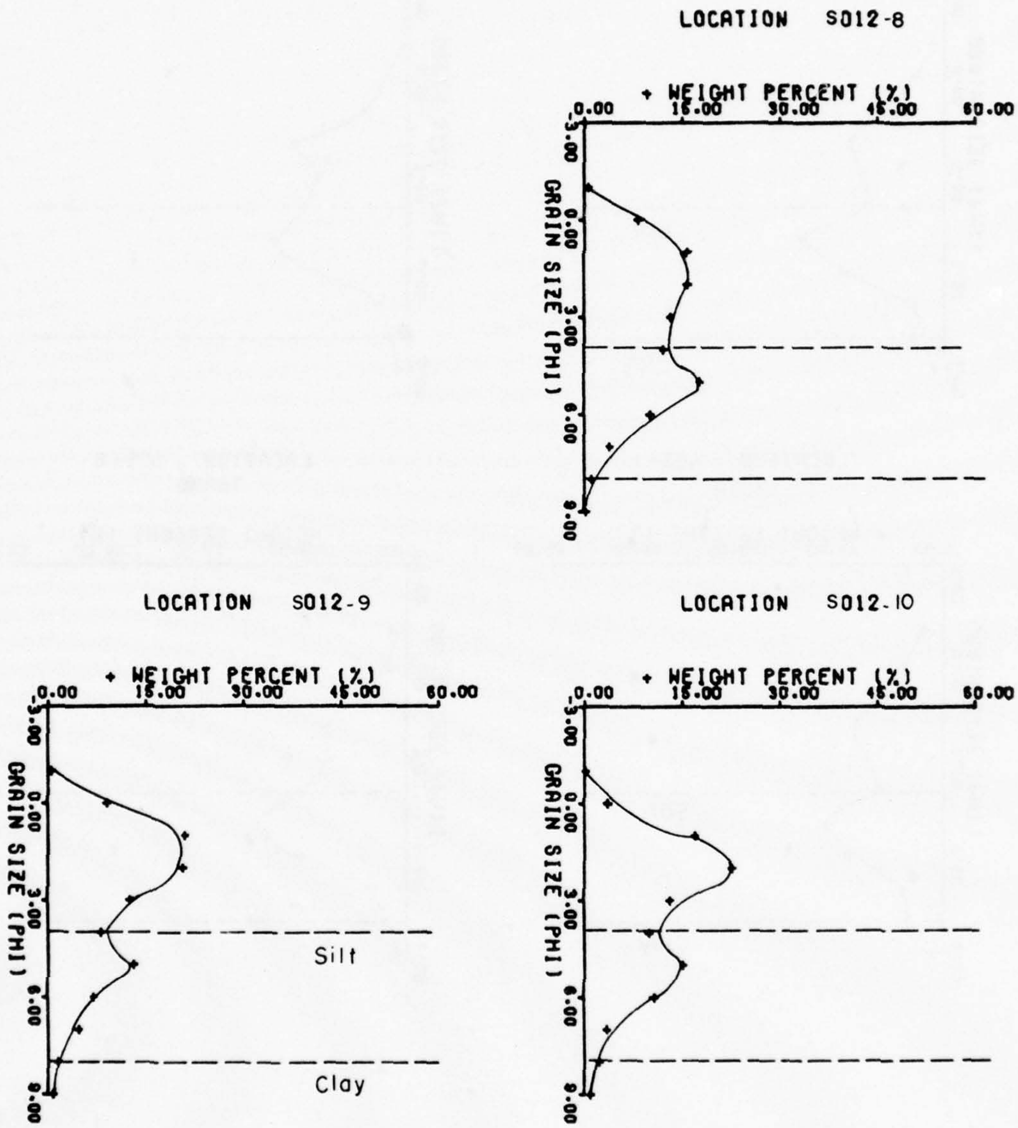


Figure U'34. (concluded)

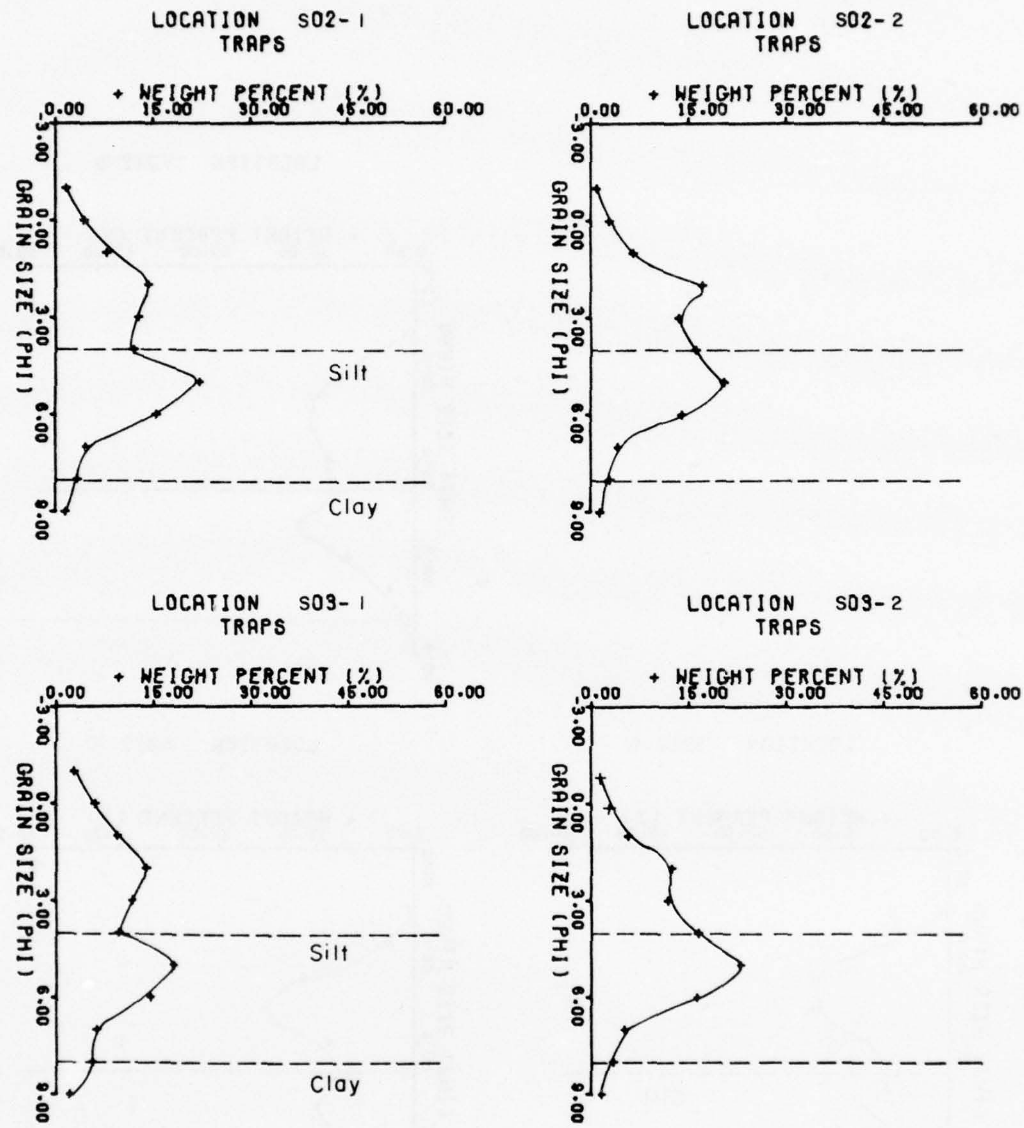


Figure U'35. Grain-size distribution in sediment traps at stations 2 and 3. Depth interval is 6.5 and 3 cm, respectively

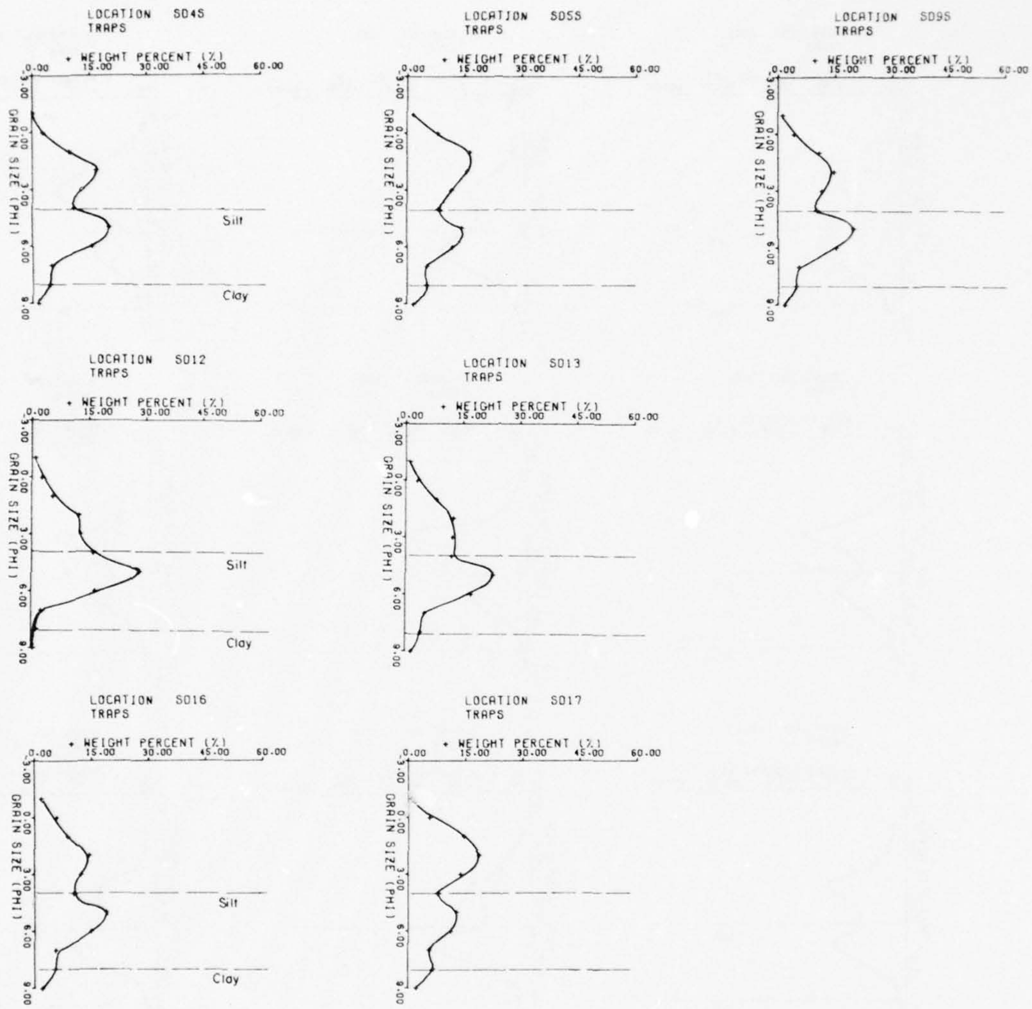


Figure U'36. Grain-size distribution of sediments in short sediment traps at stations 4, 5, 9, 12, 13, 16, and 17

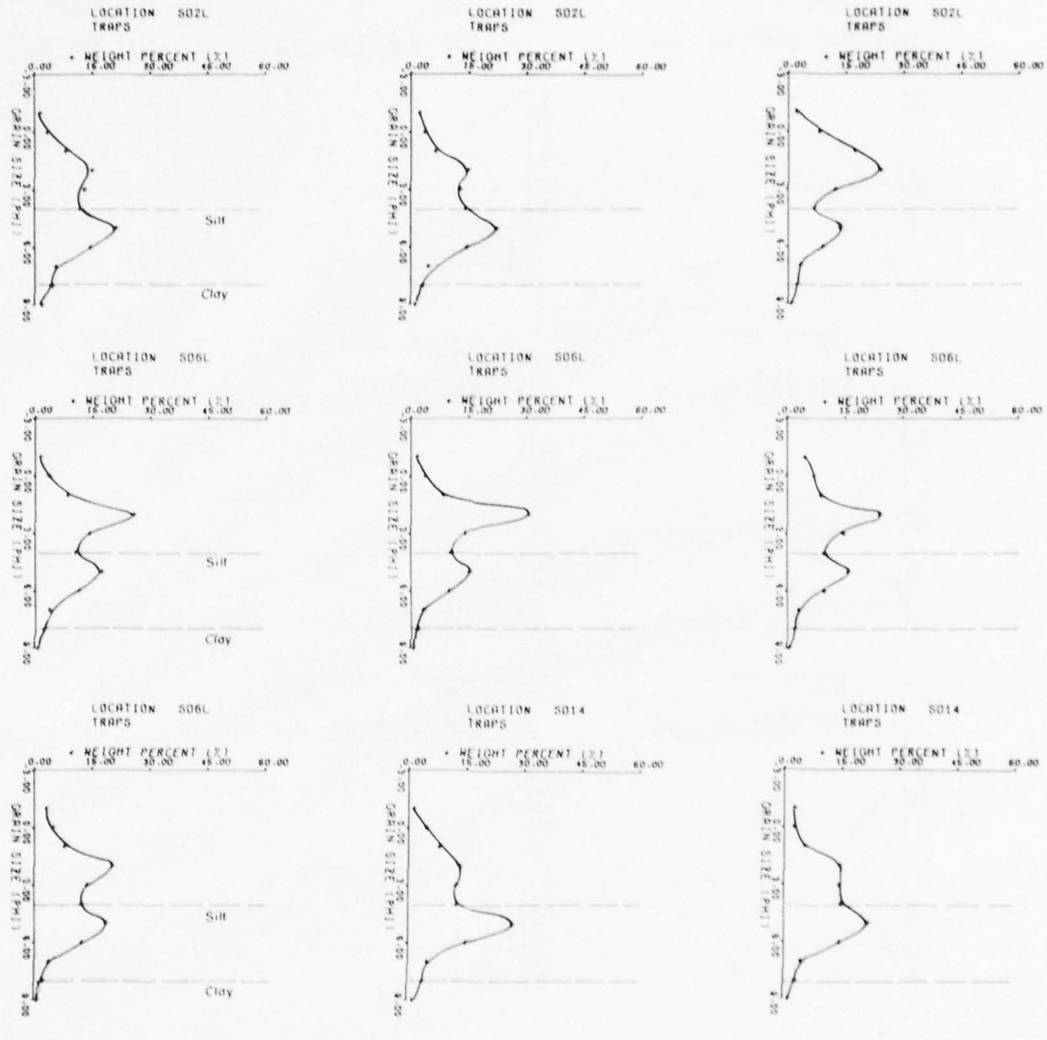


Figure U'37. Grain-size distribution of sediments in long sediment traps at stations 2, 6, and 14. Depth interval is 4 cm at 2 and 14, and 3 cm at 6

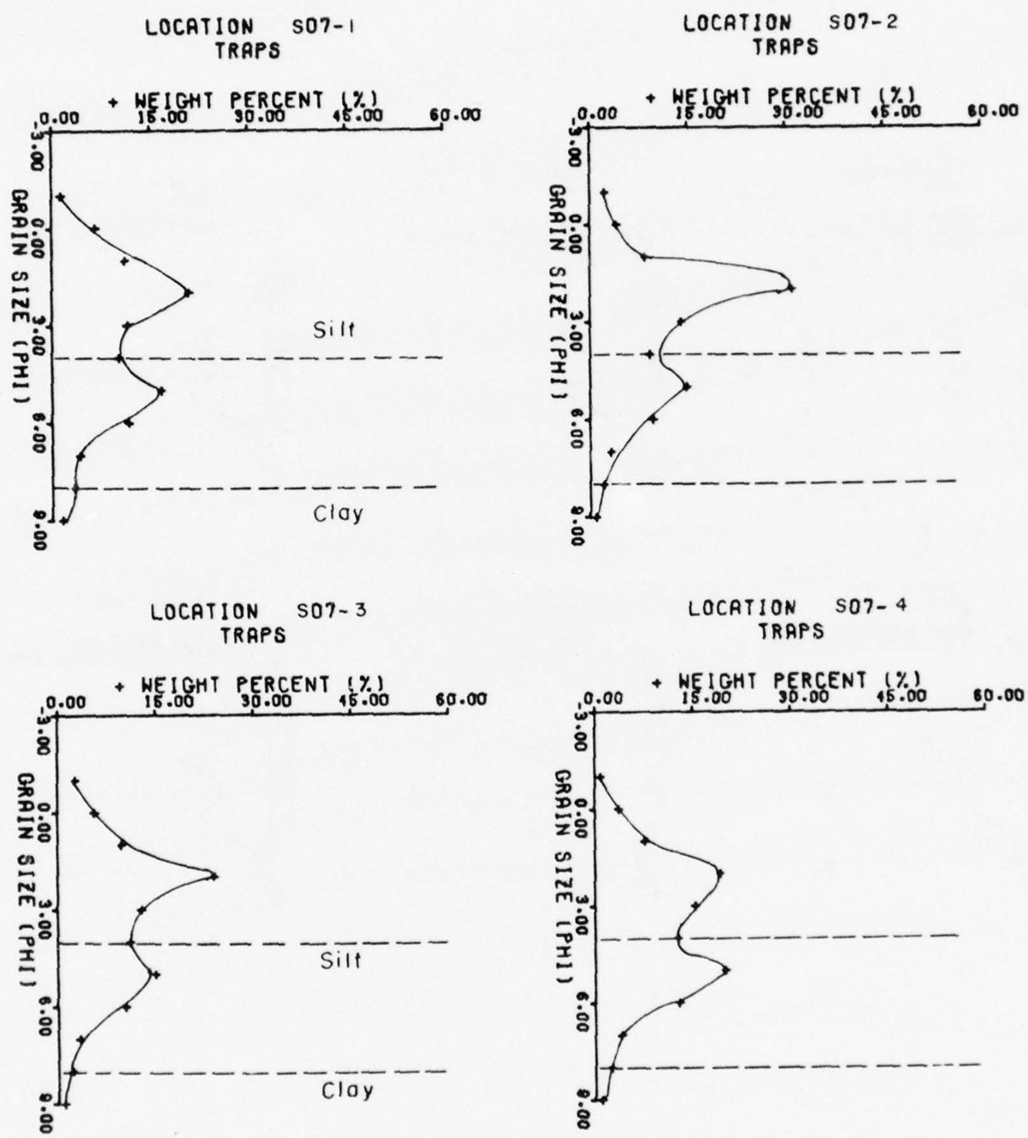


Figure U'38. Grain-size distribution of sediments in long sediment traps at station 7. Depth interval is 5 cm

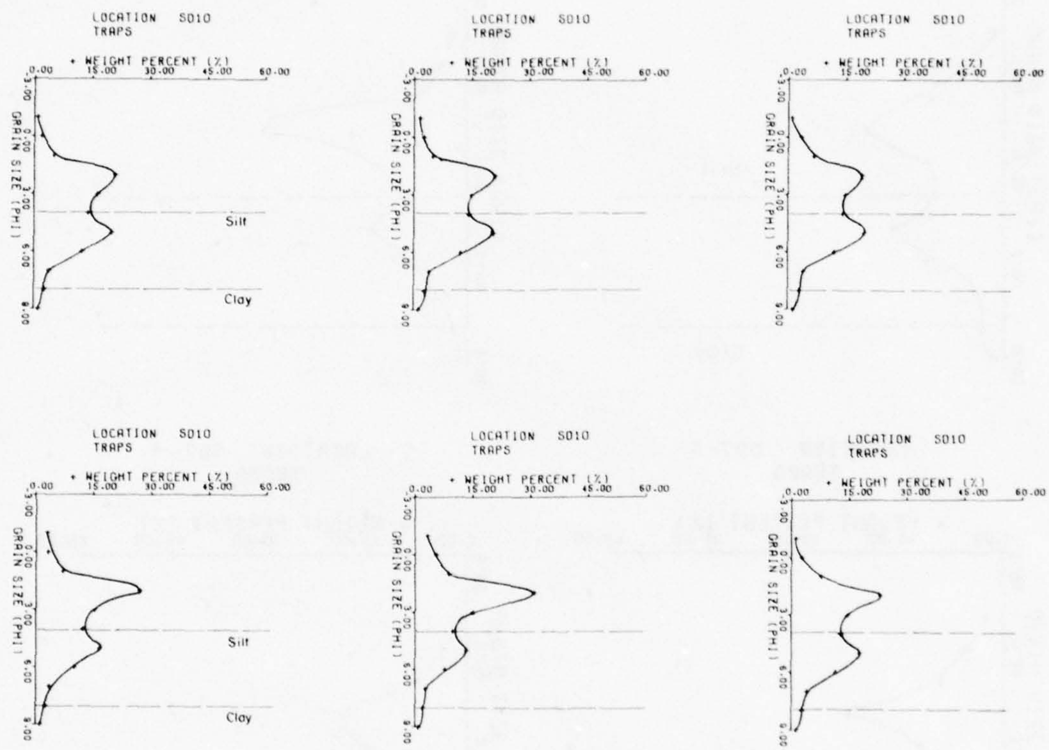


Figure U'39. Grain-size distribution of sediments in sediment traps at station 10. Depth interval is 5 cm

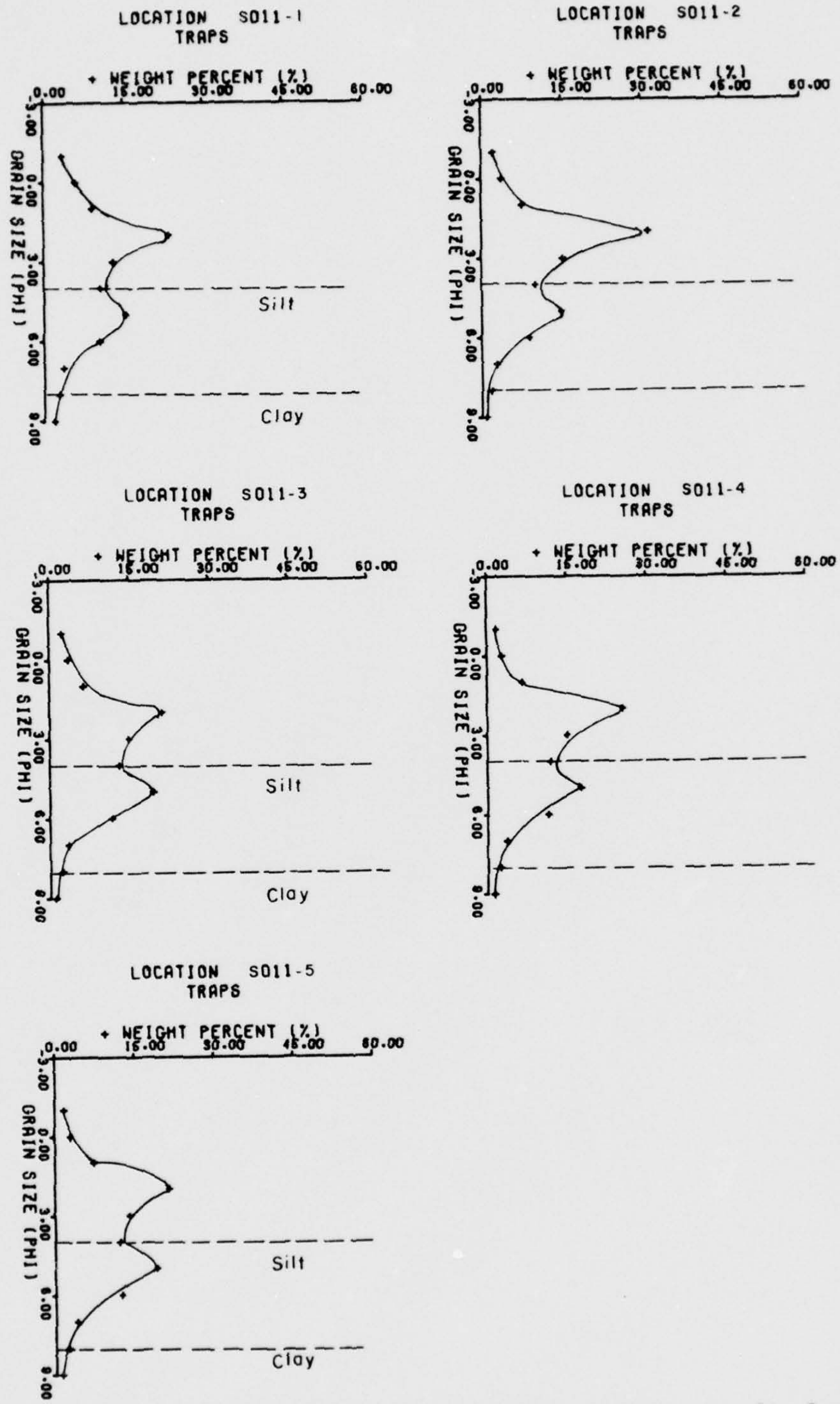
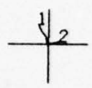


Figure U'40. Grain-size distribution of sediments in long sediment traps at station 11. Depth interval is 4.5 cm

APPENDIX V': MONTHLY SEDIMENT TRANSPORT ESTIMATES (SEDMOT)

EROSION VELOCITY (CM/SEC) = 22.000
DEPOSITION VELOCITY (CM/SEC) = 5.000
GRAIN SIZE (MM) = 0.750

EROSION VELOCITY (CM/SEC) = 15.000
DEPOSITION VELOCITY (CM/SEC) = 3.000
GRAIN SIZE (MM) = 0.380



EROSION VELOCITY (CM/SEC) = 15.000
DEPOSITION VELOCITY (CM/SEC) = 2.000
GRAIN SIZE (MM) = 0.200

EROSION VELOCITY (CM/SEC) = 18.000
DEPOSITION VELOCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.100

EROSION VELOCITY (CM/SEC) = 19.000
DEPOSITION VELOCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.030

Figure V'1. PROVECS representing direction of sediment movement, July 1975

EROSION VELOCITY (CM/SEC) = 22.000

DEPOSITION VELOCITY (CM/SEC) = 5.000

GRAIN SIZE (MM) = 0.750

EROSION VELOCITY (CM/SEC) = 15.000

DEPOSITION VELOCITY (CM/SEC) = 3.000

GRAIN SIZE (MM) = 0.380

EROSION VELOCITY (CM/SEC) = 15.000

DEPOSITION VELOCITY (CM/SEC) = 2.000

GRAIN SIZE (MM) = 0.200

EROSION VELOCITY (CM/SEC) = 18.000

DEPOSIT!ON VELOCITY (CM/SEC) = 1.000

GRAIN SIZE (MM) = 0.100

EROSION VELOCITY (CM/SEC) = 19.000

DEPOSITION VELOCITY (CM/SEC) = 1.000

GRAIN SIZE (MM) = 0.030

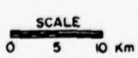
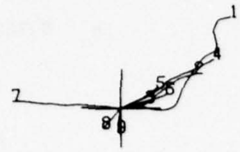
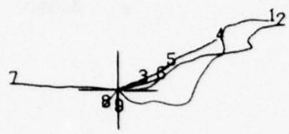


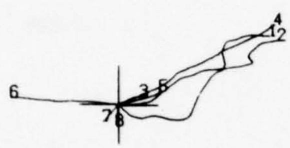
Figure V'2. PROVECS representing direction of sediment movement, August 1975



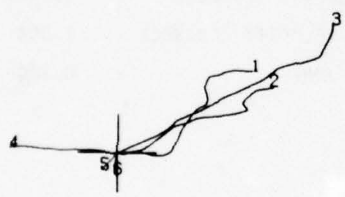
EROSION VELOCITY (CM/SEC) = 22.000
DEPOSITION VELOCITY (CM/SEC) = 5.000
GRAIN SIZE (MM) = 0.750



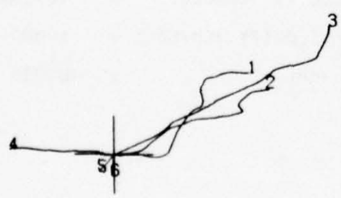
EROSION VELOCITY (CM/SEC) = 15.000
DEPOSITION VELOCITY (CM/SEC) = 3.000
GRAIN SIZE (MM) = 0.380



EROSION VELOCITY (CM/SEC) = 15.000
DEPOSITION VELOCITY (CM/SEC) = 2.000
GRAIN SIZE (MM) = 0.200



EROSION VELOCITY (CM/SEC) = 18.000
DEPOSITION VELOCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.100



EROSION VELOCITY (CM/SEC) = 19.000
DEPOSITION VELOCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.030

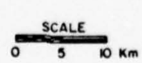
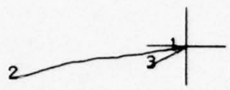


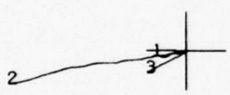
Figure V'3. PROVECS representing direction of sediment movement, September 1975

EROSION VELOCITY (CM/SEC) = 22.000
DEPOSITION VELOCITY (CM/SEC) = 5.000
GRAIN SIZE (MM) = 0.750

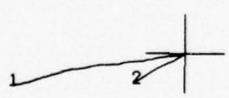
EROSION VELOCITY (CM/SEC) = 15.000
DEPOSITION VELOCITY (CM/SEC) = 3.000
GRAIN SIZE (MM) = 0.380



EROSION VELOCITY (CM/SEC) = 15.000
DEPOSITION VELOCITY (CM/SEC) = 2.000
GRAIN SIZE (MM) = 0.200



EROSION VELOCITY (CM/SEC) = 18.000
DEPOSITION VELOCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.100



EROSION VELOCITY (CM/SEC) = 19.000
DEPOSITION VELOCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.030

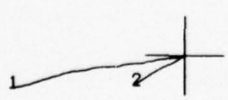
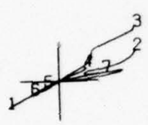


Figure V'4. PROVECS representing direction of sediment movement, October 1975

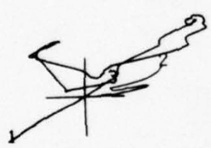
ERØSIØN VELØCITY (CM/SEC) = 22.000
DEPØSITIØN VELØCITY (CM/SEC) = 5.000
GRAIN SIZE (MM) = 0.750

ERØSIØN VELØCITY (CM/SEC) = 15.000
DEPØSITIØN VELØCITY (CM/SEC) = 3.000
GRAIN SIZE (MM) = 0.380

ERØSIØN VELØCITY (CM/SEC) = 15.000
DEPØSITIØN VELØCITY (CM/SEC) = 2.000
GRAIN SIZE (MM) = 0.200



ERØSIØN VELØCITY (CM/SEC) = 18.000
DEPØSITIØN VELØCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.100



ERØSIØN VELØCITY (CM/SEC) = 19.000
DEPØSITIØN VELØCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.030

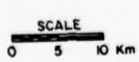
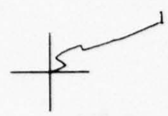


Figure V'5. PROVECS representing direction of sediment movement, November 1975

EROSION VELOCITY (CM/SEC) = 22.000

DEPOSITION VELOCITY (CM/SEC) = 5.000

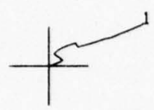
GRAIN SIZE (MM) = 0.750



EROSION VELOCITY (CM/SEC) = 15.000

DEPOSITION VELOCITY (CM/SEC) = 3.000

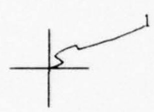
GRAIN SIZE (MM) = 0.380



EROSION VELOCITY (CM/SEC) = 15.000

DEPOSITION VELOCITY (CM/SEC) = 2.000

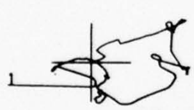
GRAIN SIZE (MM) = 0.200



EROSION VELOCITY (CM/SEC) = 18.000

DEPOSITION VELOCITY (CM/SEC) = 1.000

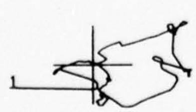
GRAIN SIZE (MM) = 0.100



EROSION VELOCITY (CM/SEC) = 19.000

DEPOSITION VELOCITY (CM/SEC) = 1.000

GRAIN SIZE (MM) = 0.030



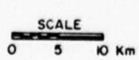


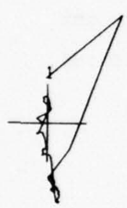
Figure V'6. PROVECS representing direction of sediment movement, December 1975

ERØSIØN VELOCITY (CM/SEC) = 22.000
DEPØSITIØN VELOCITY (CM/SEC) = 5.000
GRAIN SIZE (MM) = 0.750

ERØSIØN VELOCITY (CM/SEC) = 15.000
DEPØSITIØN VELOCITY (CM/SEC) = 3.000
GRAIN SIZE (MM) = 0.380

ERØSIØN VELOCITY (CM/SEC) = 15.000
DEPØSITIØN VELOCITY (CM/SEC) = 2.000
GRAIN SIZE (MM) = 0.200

ERØSIØN VELOCITY (CM/SEC) = 18.000
DEPØSITIØN VELOCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.100



ERØSIØN VELOCITY (CM/SEC) = 19.000
DEPØSITIØN VELOCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.030

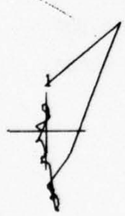


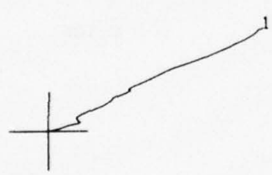
Figure V'7. PROVECS representing direction of sediment movement, January 1976

EROSION VELOCITY (CM/SEC) = 22.000
DEPOSITION VELOCITY (CM/SEC) = 5.000
GRAIN SIZE (MM) = 0.750

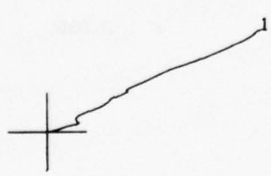
EROSION VELOCITY (CM/SEC) = 15.000
DEPOSITION VELOCITY (CM/SEC) = 3.000
GRAIN SIZE (MM) = 0.380

EROSION VELOCITY (CM/SEC) = 15.000
DEPOSITION VELOCITY (CM/SEC) = 2.000
GRAIN SIZE (MM) = 0.200

EROSION VELOCITY (CM/SEC) = 18.000
DEPOSITION VELOCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.100



EROSION VELOCITY (CM/SEC) = 19.000
DEPOSITION VELOCITY (CM/SEC) = 1.000
GRAIN SIZE (MM) = 0.030



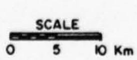


Figure V'8. PROVECS representing direction of sediment movement, March 1976

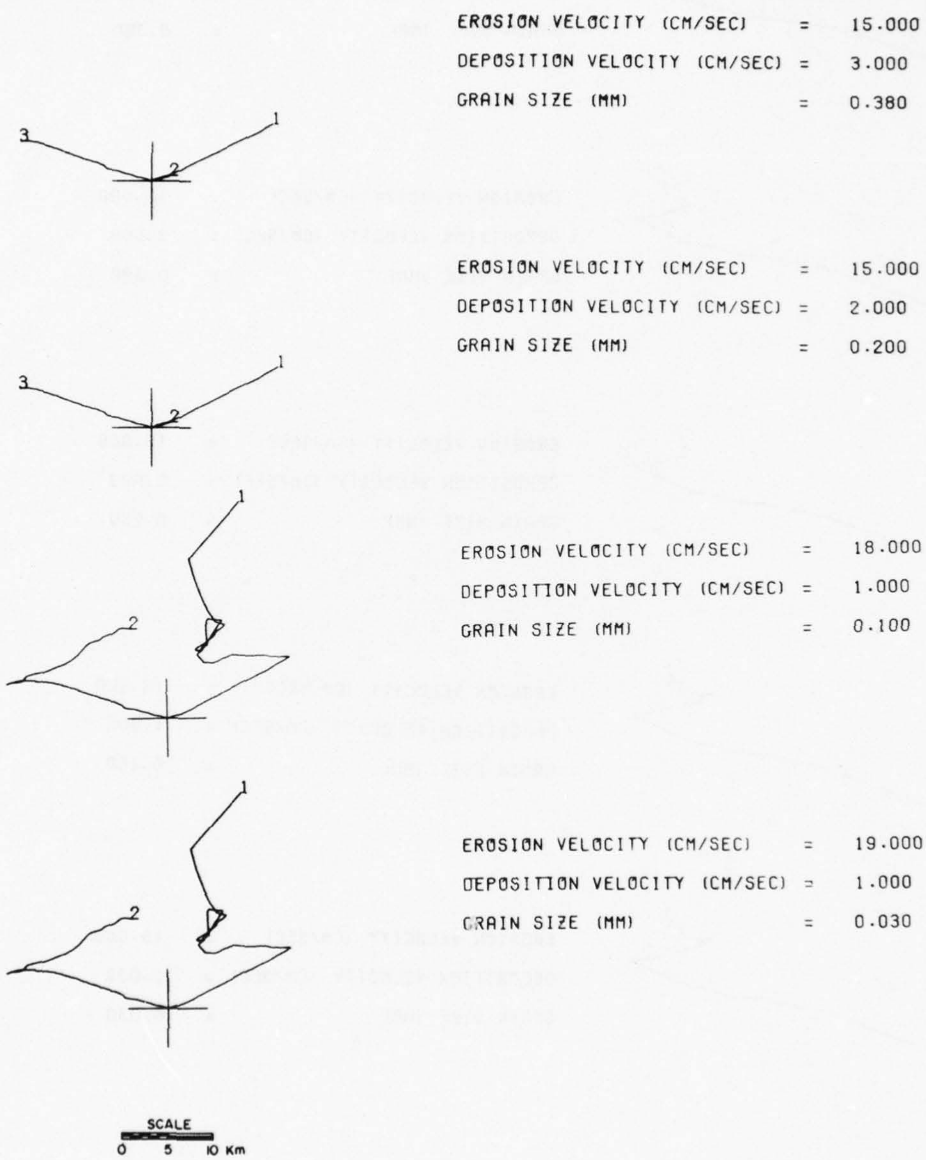


Figure V'9. PROVECS representing direction of sediment movement, April 1976

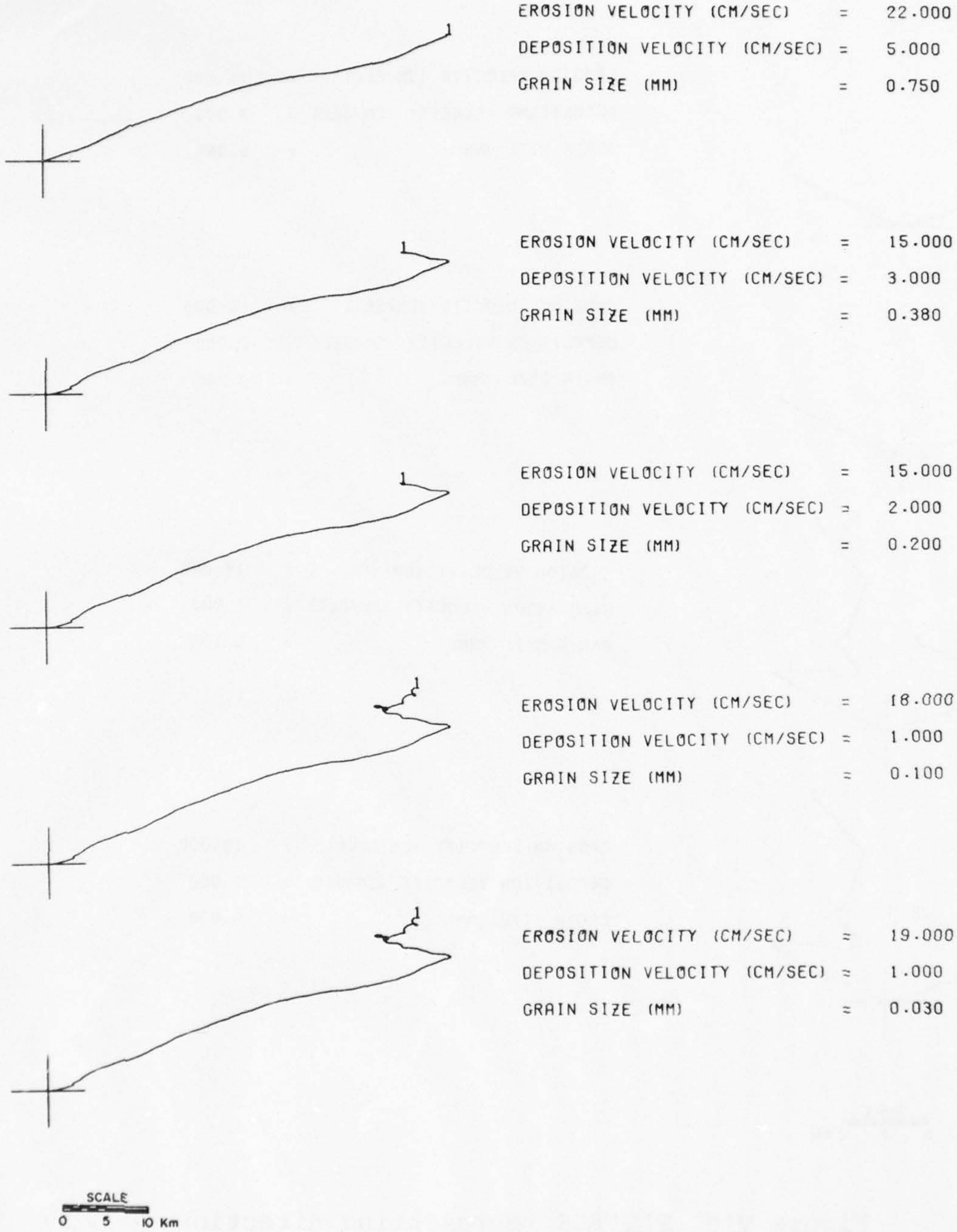


Figure V'10. PROVECS representing direction of sediment movement, May 1976

APPENDIX W': MEASUREMENTS TAKEN DURING DISPOSAL OPERATIONS

Table W'1

Transmissivity at Anchored Vessel Station A1, Disposal Site D2, During MARKHAM Pass Through with No Disposal, 5 August 1975, 1119-39 EDT

Depth m	Transmissivity, Percent				
	Background		Time, 10-minute intervals		
	Down	Up	0	10	20
Surface	-	-	-	-	-
1	21	22	21	22	22
8	21	21	21	22	22
14	23	22	23	22	14
15	22	20	20	20	22
16	17	16	17	16	18
17	13	14	14	13	14

Table W'2

Transmissivity at Anchored Vessel Station A2, Disposal Site D2, During MARKHAM Pass Through with No Disposal, 5 August 1975, 1119-39 EDT

Depth m	Transmissivity, Percent				
	Background		Time, 10-minute intervals		
	Down	Up	0	10	20
Surface	36	36	36	35	37
1	36	36	37	33	36
8	37	36	36	36	36
14	41	39	40	42	40
15	39	37	39	40	39
16	28	27	29	28	30
17	22	22	21	23	22

Table W'3

Transmissivity at Anchored Vessel Station A3, Disposal Site D2, During MARKHAM Pass Through with No Disposal, 5 August 1975, 1119-39 EDT

Depth m	Transmissivity, Percent				
	Background		Time, 10-minute intervals		
	Down	Up	0	10	20
Surface	37	39	38	37	39
1	37	37	38	36	38
8	38	38	37	37	38
14	43	41	43	42	42
15	41	34	40	41	38
16	29	28	32	30	30
17	21	24	24	21	23

Table W'4

Transmissivity at Anchored Vessel Station A4, Disposal Site D2, During MARKHAM Pass Through with No Disposal, 5 August 1975, 1119-39 EDT

Depth m	Transmissivity, Percent: Background Down	Background Up	Time, 10-minute intervals: 0	10	20
Surface	-	-	-	-	-
1	45	45	48	48	49
8	44	44	44	44	44
14	48	48	49	51	51
15	47	44	47	36	48
16	28	25	26	26	28
17	20	16	14	18	14

Table W'5

Transmissivity at Moving Vessel Stations, Disposal Site D2, During MARKHAM Pass Through with No Disposal, 5 August 1975, 1119-39 EDT

Depth m	Transmissivity, Percent				
	Station				
	M1	M2	M3	M4	M5
	Time of Sampling				
	1118	1126	1132	1138	1144
Surface	91	-	92	91	91
1	91	-	92	91	-
8	91	-	92	91	91
14	92	-	92	91	87
15	92	93	92	91	92
16.5	90	93	87	87	99
17	55	87	84	85	84

Table W'6

Transmissivity at Anchored Vessel Station, A1, Disposal Site D2, During Harbor Sediment Disposal, 5 August 1975, 1240-1323 EDT

Depth	Transmissivity, Percent							
	Background		Time, 10-minute intervals					
m	Down	Up	0	10	20	30	40	50
Surface	-	-	-	-	-	-	-	-
1	20	21	21	22	26	28	23	24
8	20	20	21	22	24	26	23	22
14	22	21	23	22	1	26	22	14
15	21	20	21	22	1	0.45	24	24
16	19	17	18	17	18	22	21	20
17	13	13	17	0.16	0.17	0.18	0.42	2

Table W'7

Transmissivity at Anchored Vessel Station A2, Disposal Site D2, During Harbor Sediment Disposal, 5 August 1975, 1240-1323 EDT

Depth	Transmissivity, Percent					
	Background		Time, 10-minute intervals			
m	Down	Up	0	10	20	30
Surface	40	39	42	-[a]	50	50
1	39	38	42	-	46	48
8	38	38	40	-	48	48
14	44	43	44	-	48	48
15	41	38	44	-	46	46
16	35	32	36	-	46	46
17	26	25	25	-	44	44

[a] Instrument malfunction - change from Montedoro Whitney transmissometer to Martek transmissometer.

Note: Instrument: Montedoro-Whitney, Martek.

Table W'8

Transmissivity at Anchored Vessel Station A3, Disposal Site D2, During Harbor Sediment Disposal, 5 August 1975, 1240-1323 EDT

Depth	Transmissivity, Percent					
	Background		Time, 10-minute intervals			
m	Down	Up	0	10	20	30
Surface	37	38	37	35	36	37
1	38	37	38	35	37	37
8	37	36	36	37	35	36
14	39	40	42	42	42	42
15	39	37	39	33	41	42
16	34	32	32	26	30	36
17	25	22	24	22	21	23

Note: Instrument: Montedoro-Whitney.

Table W'9

Transmissivity at Anchored Vessel Station A4, Disposal Site D2, During Harbor Sediment Disposal, 5 August 1975, 1240-1323 EDT

Depth	Transmissivity, Percent						
	Background		Time, 10-minute intervals				
m	Down	Up	0	10	20	30	40
Surface	-	-	-	-	-	-	-
1	47	45	47	49	45	44	45
8	41	38	42	39	38	37	37
14	50	50	49	50	49	49	50
15	49	48	49	44	48	48	49
16	27	25	31	32	28	13	30
17	18	17	4	19	18	18	19

Note: Instrument: Montedoro-Whitney

Table W'10

Transmissivity at Moving Vessel Stations, Disposal Site D2, During Harbor Sediment Disposal, 5 August 1975, 1240-1310 EDT

Depth m	Transmissivity, Percent						
	Station						
	M1	M1-2	M2	M3	M4	M5	M6
	Time of Sampling						
	1240	1245	1250	1251	1254	1258	1300
Surface	25	-	90	91	91	91	86
1	45	91	91	91	91	-	86
2	68	-	-	-	-	-	-
5	65	-	-	-	-	-	78
8	-	89	90	91	91	-	-
10	86	-	-	-	-	-	54
11	85	-	-	-	-	91	47
12	90	-	-	-	-	-	45
13	90	-	-	-	-	-	65
14	91	91	92	92	92	92	85
15	91	91	92	91	92	92	90
16	5	91	91	88	92	92	84
17	0.5	88	10	84	92	92	45

Note: Instrument: Hydro Products 612A.

Table W'11

Transmissivity at Anchored Vessel Station A1, Disposal Site D8, During River Sediment Disposal, 5 August 1975, 1430-1530 EDT

Depth	Background		Transmissivity, Percent						
			Time, 10-minute intervals						
m	Down	Up	0	10	20	30	40	50	60
Surface	-	-	-	-	-	-	-	-	-
1	21	21	21	22	20	19	17	15	14
8	11	11	10	15	4	1	5	1	9
12	-	-	23	0.24	1	14	11	11	11
13	-	-	23	0.2	0.28	14	11	13	14
14	21	20	22	0.18	2	1	4	0.26	0.24
14.5	-	-	20	0.17	0.35	6	0.62	0.22	-
15	0.22	0.23	-	-	-	-	-	-	-

Note: Instrument: Montedoro-Whitney.

Table W'12

Transmissivity at Anchored Vessel Station A2, Disposal Site D8, During River Sediment Disposal, 5 August 1975, 1430-1530 EDT

Depth	Transmissivity, Percent								
	Background		Time, 10-minute intervals						
m	Down	Up	0	10	20	30	40	50	60
Surface	50	46	46	48	48	48	48	46	44
1	48	42	46	44	46	48	48	44	44
8	6	8	10	10	18	14	16	12	16
12	42	52	42	42	38	34	34	34	32
13	50	44	50	54	44	32	24	26	22
14	50	50	50	-	0	0	0	7	14

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AQUATIC DISPOSAL FIELD INVESTIGATIONS ASHTABULA RIVER DISPOSAL --ETC(U)
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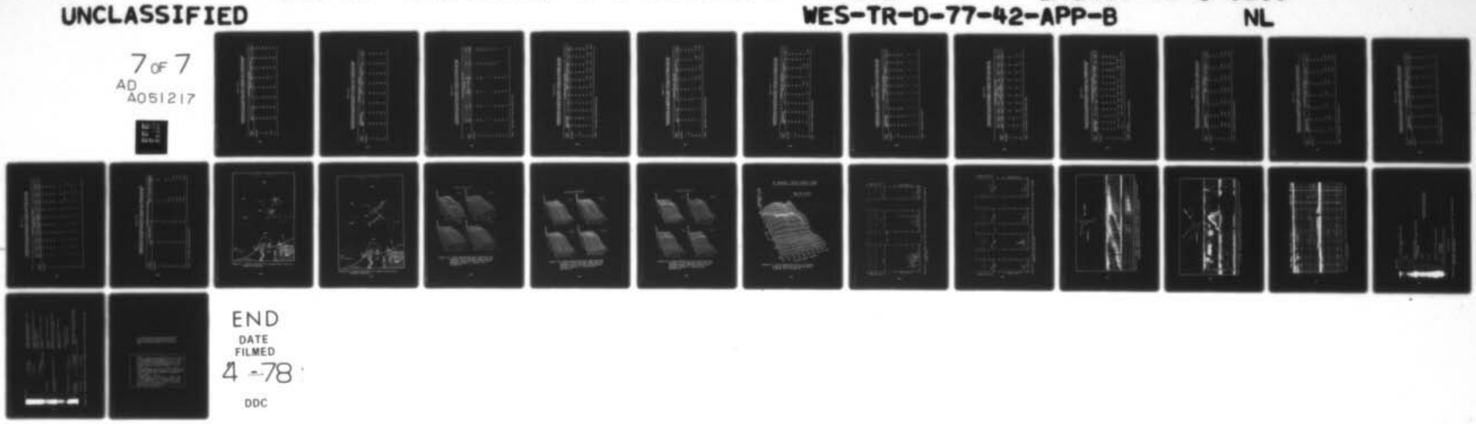

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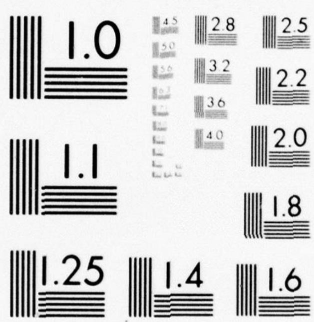

MICROCOPY RESOLUTION TEST CHART
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Table W'13

Transmissivity at Anchored Vessel Station A3, Disposal Site D8, During River Sediment Disposal, 5 August 1975, 1430-1530 EDT

Depth m	Transmissivity, Percent							
			Time, 10-minute intervals					
	Down	Up	0	10	20	30	40	50
Surface	36	36	37	37	36	37	35	36
1	36	37	37	37	35	38	36	34
8	14	18	14	18	27	28	25	14
12	39	35	32	34	30	30	26	30
13.5	39	39	39	36	30	29	29	24
14	39	39	38	34	-	30	28	23

Table W'14

Transmissivity at Anchored Vessel Station A4, Disposal Site D8, During River Sediment Disposal, 5 August 1975, 1428-1530 EDT

Depth m	Transmissivity, Percent							
	Background		Time, 10-minute intervals					
	Down	Up	0	10	20	30	40	50
Surface	-	-	-	-	-	-	-	-
1	39	36	40	39	37	37	37	40
8	29	27	29	31	32	33	33	32
12	34	33	28	33	34	33	36	31
13	38	40	33	41	42	40	36	33
14	32	34	27	26	28	19	17	18

Table W'15

Transmissivity at Moving Vessel Stations, Disposal Site D8, During River Sediment Disposal, 5 August 1975, 1430-1530 EDT

Depth m	Transmissivity, Percent					
	Station					
	M1	M2	M3	M4	M5	M6
	Time of Sampling					
	1427	1434	1438	1441	1445	1448
Surface	-	-	-	-	-	-
1	90	90	90	87	87	86
8	81	82	79	86	86	85
11	-	-	-	-	80	80
12	-	-	-	-	87	85
13	-	-	-	-	87	60
14	90	90	87	90	87	12
15	90	65	89	90	-	-
16	90	20	30	18	-	-
17	0	9	0	17	-	-

Note: Instrument: Hydro Products 612A.

Table W'16

Transmissivity at Anchored Vessel Station A1, Disposal Site D2, During Harbor Sediment Disposal, 8 August 1975, 0918-1030 EDT

Depth m	Background Down	Background Up	Transmissivity, Percent — Time, 10-minute intervals: 0	10	20	30	40	50	60	70	80
Surface	38	39	33	37	38	30	38	37	39	38	38
1	38	38	38	37	38	33	38	36	39	38	38
8.5	38	38	38	37	38	38	38	36	37	37	36
12	38	38	38	37	38	38	33	36	28	37	37
14	12	11	16	12	10	14	0.04	0.04	0.04	0.05	0.06
16	9	9	9	9	0.2	0.02	0.02	0.03	0.04	0.04	0.08

Note: Instrument: Montedoro-Whitney.

Table W'17

Transmissivity at Anchored Vessel Station A2, Disposal Site D2, During Harbor Sediment Disposal, 8 August 1975, 0918-1030 EDT

Depth m	Transmissivity, Percent							
			Time, 15-minute intervals					
	Down	Up	0	15	31	45	60	100
Surface	16	18	18	18	18	16	17	16
1	16	18	18	18	18	16	17	16
8.5	16	18	17	19	17	16	17	16
12	15	12	18	6	9	14	8	13
14	5	5	5	4	0.6	0.2	0.18	0.18
16	5	5	4	0.6	0.23	0.16	0.17	0.18

Note: Instrument: Montedoro-Whitney.

Table W'18

Transmissivity at Anchored Vessel Station A3, Disposal Site D2, During Harbor Sediment Disposal, 8 August 1975, 0918-1030 EDT

Depth m	Background Down	Background Up	Transmissivity, Percent — Time, 15-minute intervals 0	15	30	45	60	75	85
Surface	44	46	46	44	46	47	45	44	48
1	44	46	47	45	46	47	46	45	48
8.5	46	46	46	46	46	47	45	46	47
12	48	46	45	46	34	46	46	47	47
14	17	14	14	13	0.06	5	0.12	4	12
16	12	12	12	0.4	0.03	0	0.04	1	0.08

Note: Instrument: Montedoro-Whitney.

Table W'19

Transmissivity at Anchored Vessel Station A4, Disposal Site D2, During Harbor Sediment Disposal, 8 August 1975, 0918-1030 EDT

Depth m	Background Down	Background Up	Transmissivity, Percent: Time, 10-minute intervals 0	10	20	30	40	50	60	70
Surface	34	35	34	-	34	38	35	34	33	42
1	34	35	34	-	34	38	35	34	33	42
8.5	43	43	41	-	41	41	41	37	40	42
12	42	41	30	-	38	40	38	38	40	30
13	16	8	-	-	-	-	-	-	-	-
14	6	5	5	-	6	2	4	6	6	4
15	5	5	-	-	-	-	-	-	-	-
16	5	5	5	-	4	2	4	4	4	4

Note: Instrument: Martek.

Table W'20

Transmissivity at Moving Vessel Stations, Disposal Site D2, During Harbor Sediment Disposal, 8 August 1975, 0915-1100 EDT

Depth m	Transmissivity, Percent									
	Station									
	M1	M2-1	M2-2	M3	M4	M5	M6	M7	M8	M9
	Time of Sampling									
	0915	0920	0935	0950	0958	1010	1015	1030	1050	1100
Surface	-	-	-	-	-	-	-	-	-	-
1	0	9	62	63	50	64	58	50	66	24
8	62	62	-	-	-	-	-	-	-	-
12	0	0	40	52	28	56	20	35	64	5.5
16	0	0	72	72	72	0	0	0	8.5	5.5

Note: Instrument: Hydro Products 612A.

Table W'21

Transmissivity at Anchored Vessel Station A1, Disposal Site D8, During River Sediment Disposal, 8 August 1975, 1623-1731 EDT

Depth	Transmissivity, Percent											
	Background		Time, 10-minute intervals									
m	Down	Up	0	10	20	30	40	50	60	70	75	90
Surface	-	-	-	-	-	-	-	-	-	-	-	-
1	25	25	21	25	25	25	22	25	23	27	24	28
4	22	19	21	18	19	18	16	18	18	18	17	19
8	23	24	23	23	23	23	20	23	21	23	22	23
10	23	23	25	24	24	28	25	28	27	25	23	29
12	0.05	0.08	0.04	0.04	0.06	0.04	0.05	0.05	2	0.05	0.05	1
14	0.06	-	0.07	0.06	0.04	0.06	0.03[a]	0.04	0.03	0.04	0.04	0.04

[a] Meter zeroed.
Note: Instrument: Montedoro-Whitney.

Table W'22

Transmissivity at Anchored Vessel Station A2, Disposal Site D8, During River Sediment Disposal, 8 August 1975, 1623-1731 EDT

Depth m	Transmissivity, Percent						
	Background		Time, 15-minute intervals				
	Down	Up	0	15	30	45	60
Surface	13	14	12	14	20	15	16
1	13	14	12	14	15	15	15
8	9	12	11	13	13	13	14
12	0.28	0.24	0.24	0.22	0.18	0.19	0.15
13	0.28	0.26	0.25	0.23	0.18	0.19	0.15
14	0.45	0.52	0.26	0.22	0.22	0.22	0.16

Note: Instrument: Montedoro-Whitney.

Table W'23

Transmissivity at Anchored Vessel Station A3, Disposal Site D8, During River Sediment Disposal, 8 August 1975, 1623-1731 EDT

Depth m	Transmissivity, Percent						
	Background		Time, 15-minute intervals				
	Down	Up	0	15	30	45	60
Surface	25	26	29	30	25	25	27
1	26	26	29	29	25	24	26
4	20	19	22	23	19	20	20
8	24	23	24	28	24	24	24
12	1	0.2	0.04	0.08	0.06	0.06	0.20
13	0.1	0.02	2	2	0.04	0.05	0.04
14	0	0	3	4	2	0.20	0.04

Note: Instrument: Montedoro-Whitney.

Table W'24

Transmissivity at Anchored Vessel Station A4, Disposal Site D8, During River Sediment Disposal, 8 August 1975, 1623-1731 EDT

Depth	Transmissivity, Percent							
	Background		Time, 10-minute intervals					
m	Down	Up	0	10	20	30	40	50
Surface	27	27	22	24	20	23	28	26
1	27	27	20	24	20	26	25	25
4	18	18	11	16	17	17	18	18
8	20	20	14	20	21	23	22	22
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0

Note: Instrument: Martek.

Table W'25

Transmissivity at Moving Vessel Stations, Disposal Site D8, During River Sediment Disposal, 8 August 1975, 1623-1730 EDT

Depth m	Transmissivity, Percent									
	Station									
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
	Time of Sampling									
	1620	1630	1635	1645	1650	1700	1710	1720	1735	1750
Surface	0	20	28	36	39	38	38	28	38	42
1	0	15	27	34	38	34	32	28	34	38
4	30	26	26	22	21	23	23	23	22	31
8	0	38	32	32	32	29	32	28	22	30
9	-	-	-	38	-	-	-	-	-	-
10	-	-	32	38	-	31	30	36	22	-
11	-	-	-	-	-	10	30	0.6	0.3	-
12	1	0	0	0	0	0	0	0	0	0.2
13	0	0	0	0	0	0	0	0	0	6
14	0	0	0	0	0	0	2	0	0.4	4
15	-	-	-	-	-	-	3	-	3	-

Table W'26

Transmissivity at Anchored Vessel Station A2, Disposal Site D8, During River Sediment Disposal, 8 August 1975, 1830-1840 EDT

Depth m	Transmissivity, Percent			
	Background		Time, 15-minute intervals	
	Down	Up	0	10
Surface	18	16	-	-
1	18	15	13	16
8	13	12	-	-
10	14	15	12	14
11	13	12	0.98	17
12	11	12	0.19	0.16
13	11	12	0.19	0.16
14	12	13	0.19	0.17
15	13	12	0.19	0.16

Note: Instrument: Montedoro-Whitney.

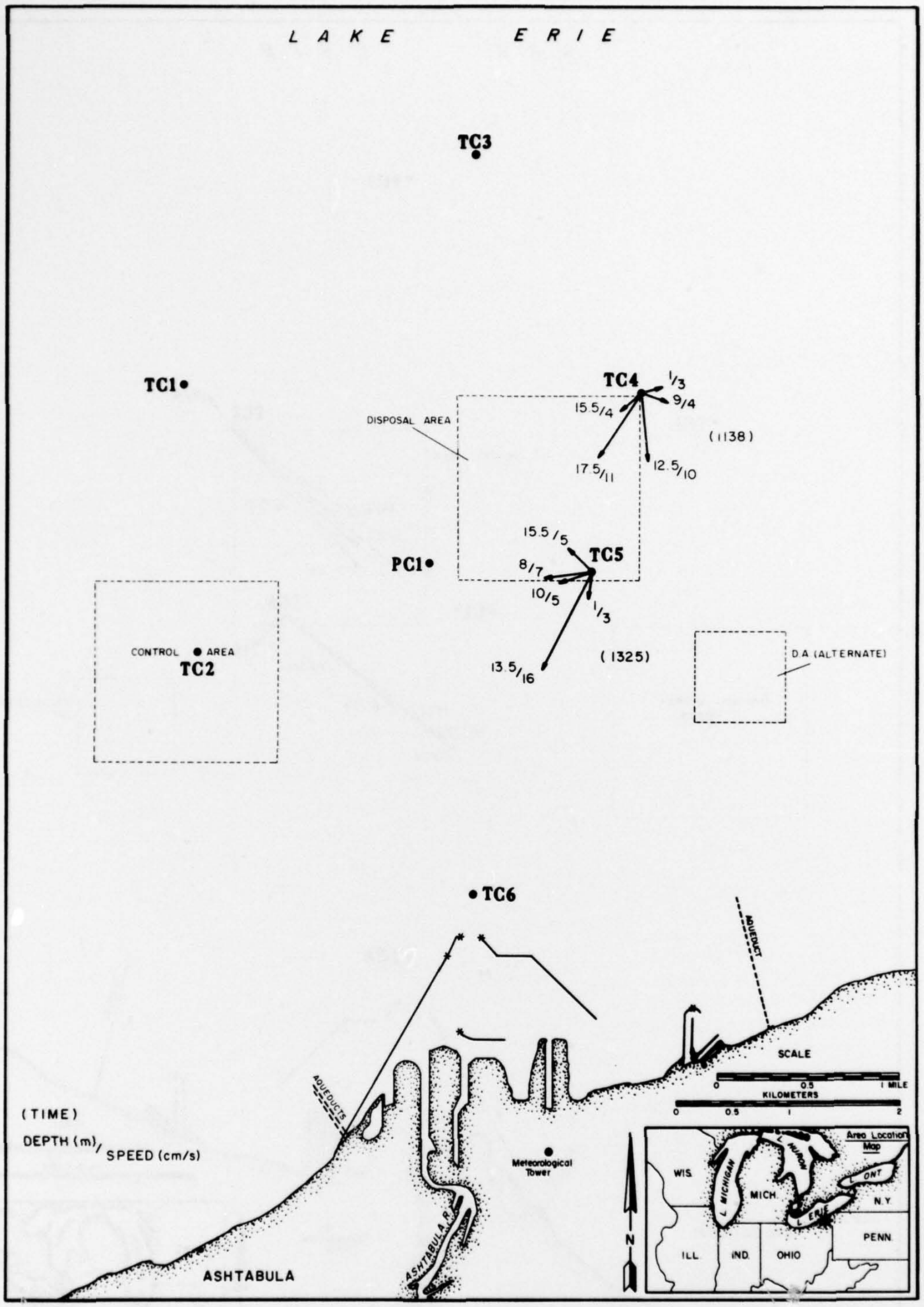


Figure W'1. Current profiles on 5 August 1975, prior to disposal operation

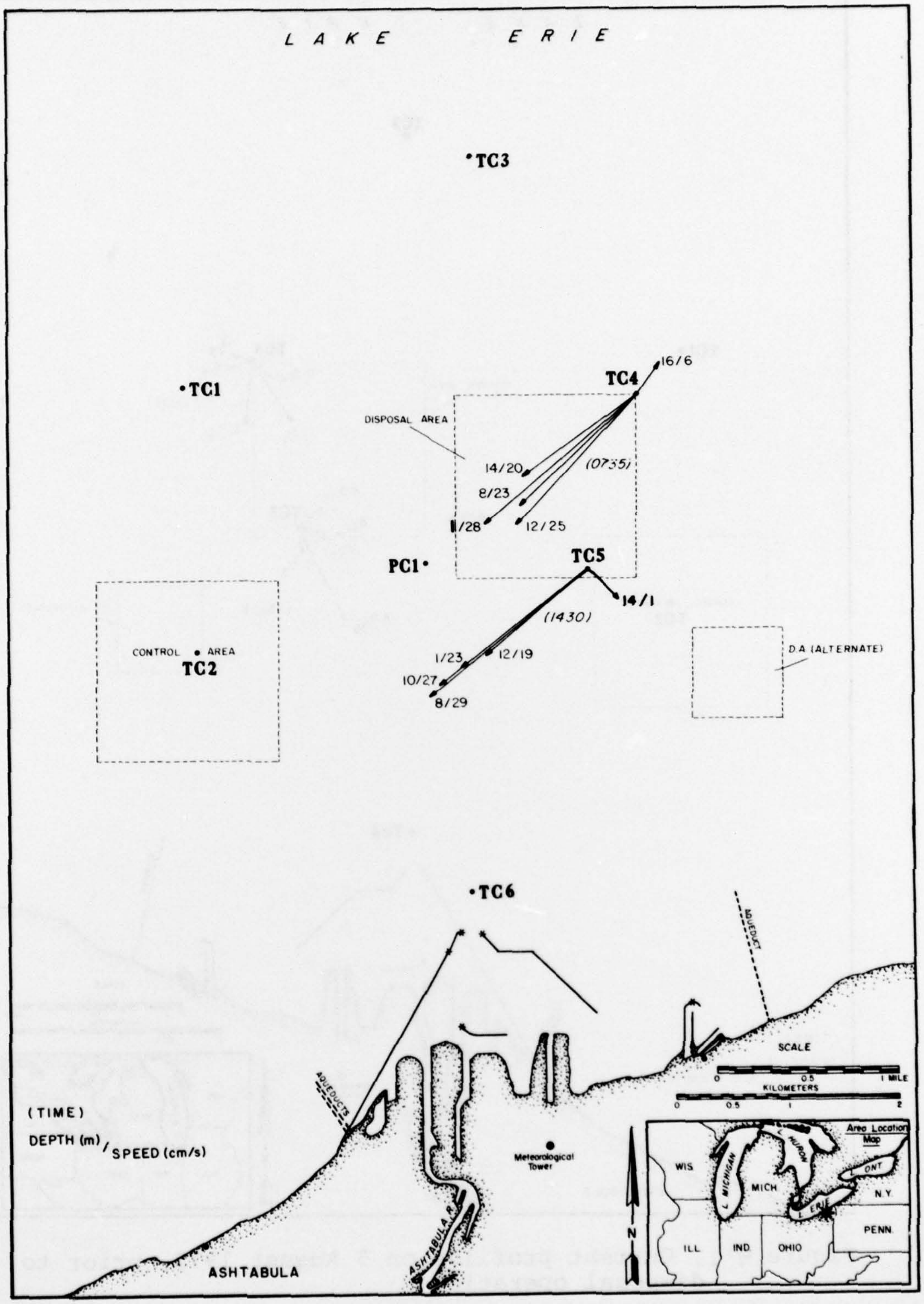


Figure W'2. Current profiles on 8 August 1975, during disposal operation

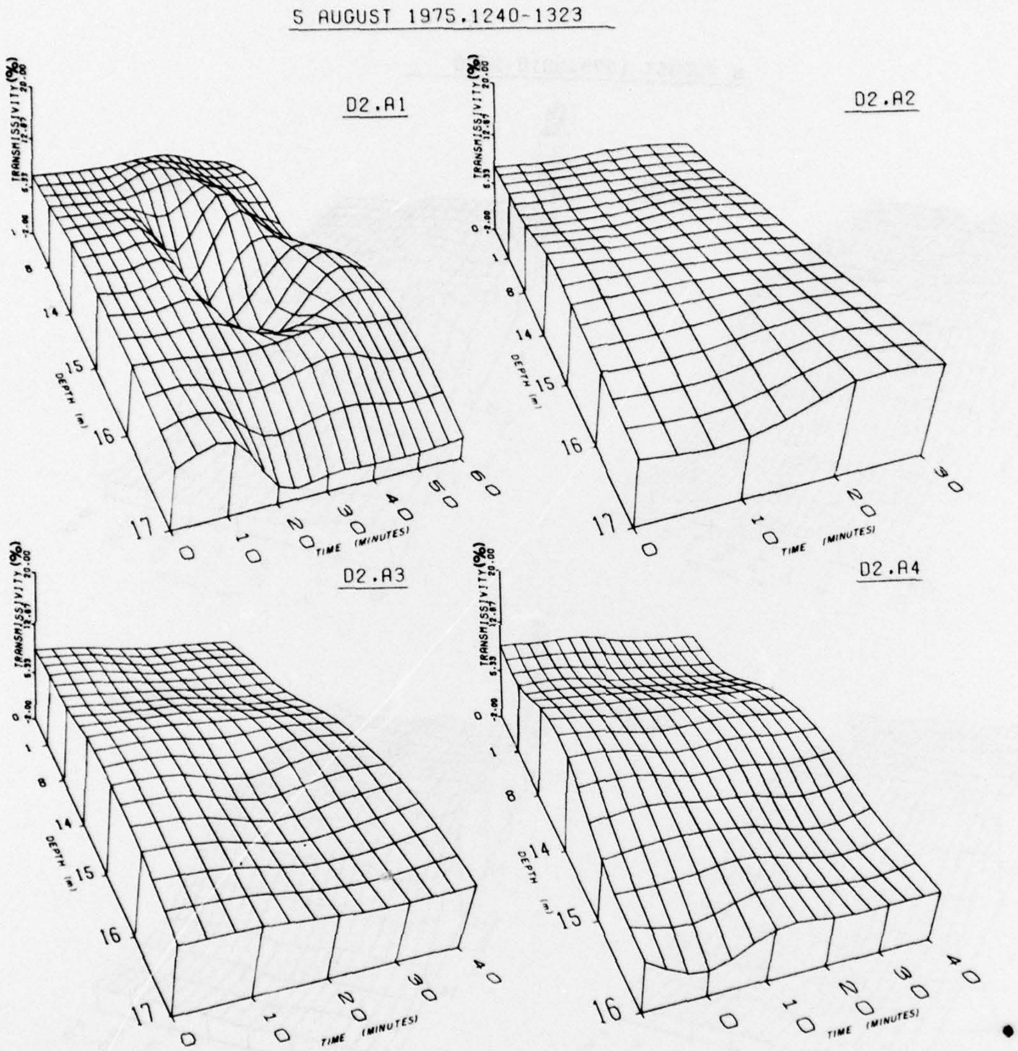


Figure W'3. Three-dimensional plots depicting the movement of the sediment plume past the anchored vessel stations during harbor sediment disposal, 5 August 1975, station D2

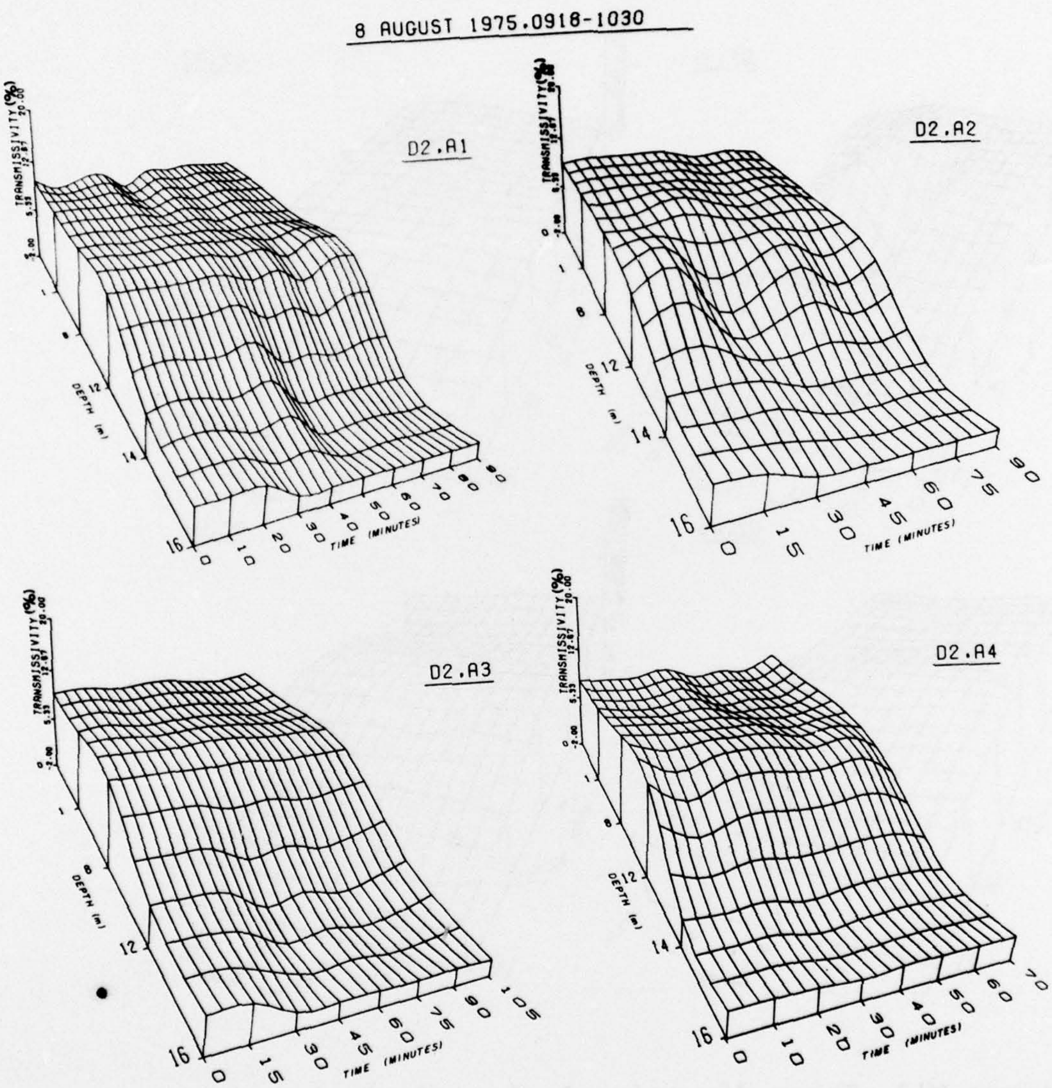


Figure W'4. Three-dimensional plots depicting the movement of the sediment plume past the anchored vessel stations during harbor sediment disposal, 8 August 1975, station D2

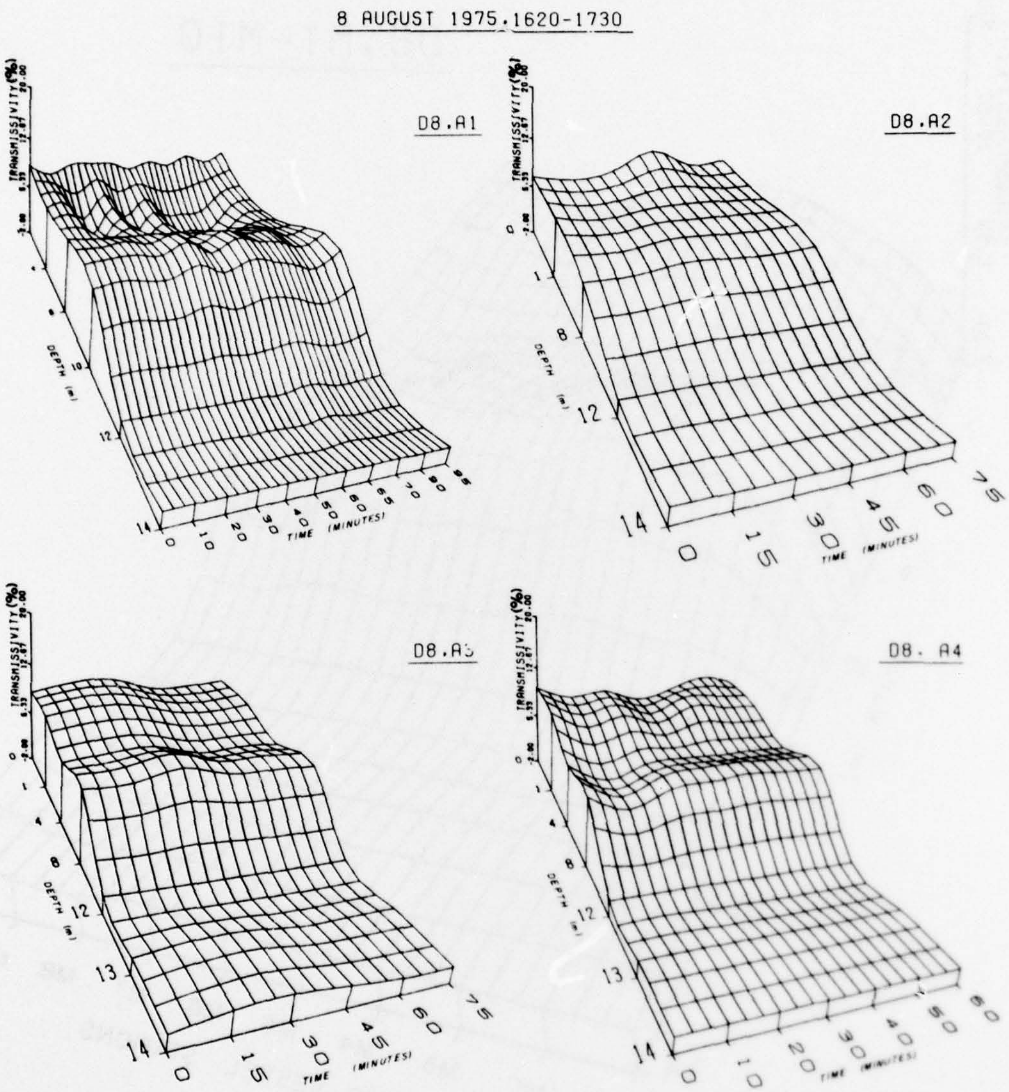


Figure W'5. Three-dimensional plots depicting the movement of the sediment plume past the anchored vessel stations during river sediment disposal, 8 August 1975, station D8

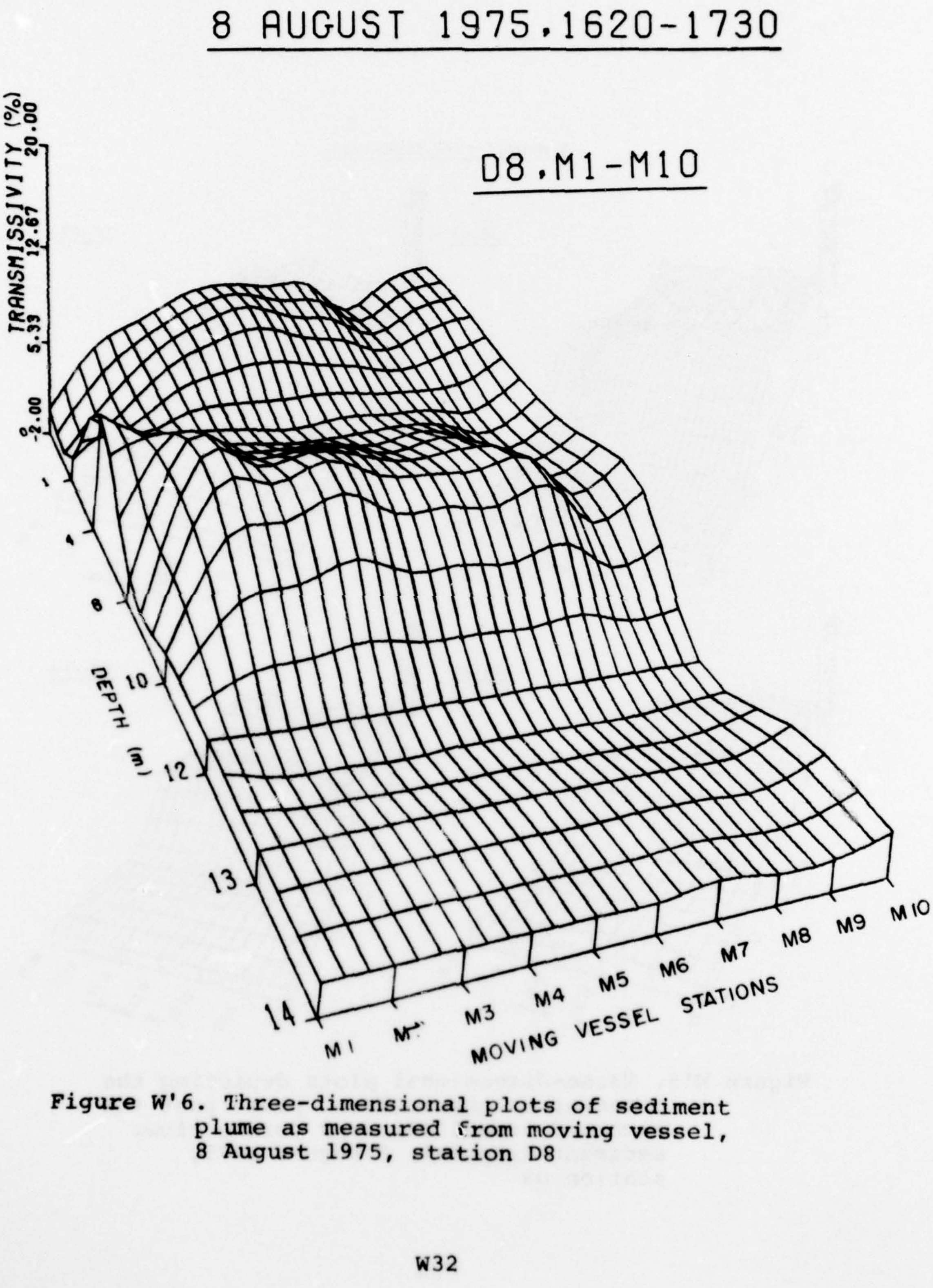


Figure W'6. Three-dimensional plots of sediment plume as measured from moving vessel, 8 August 1975, station D8

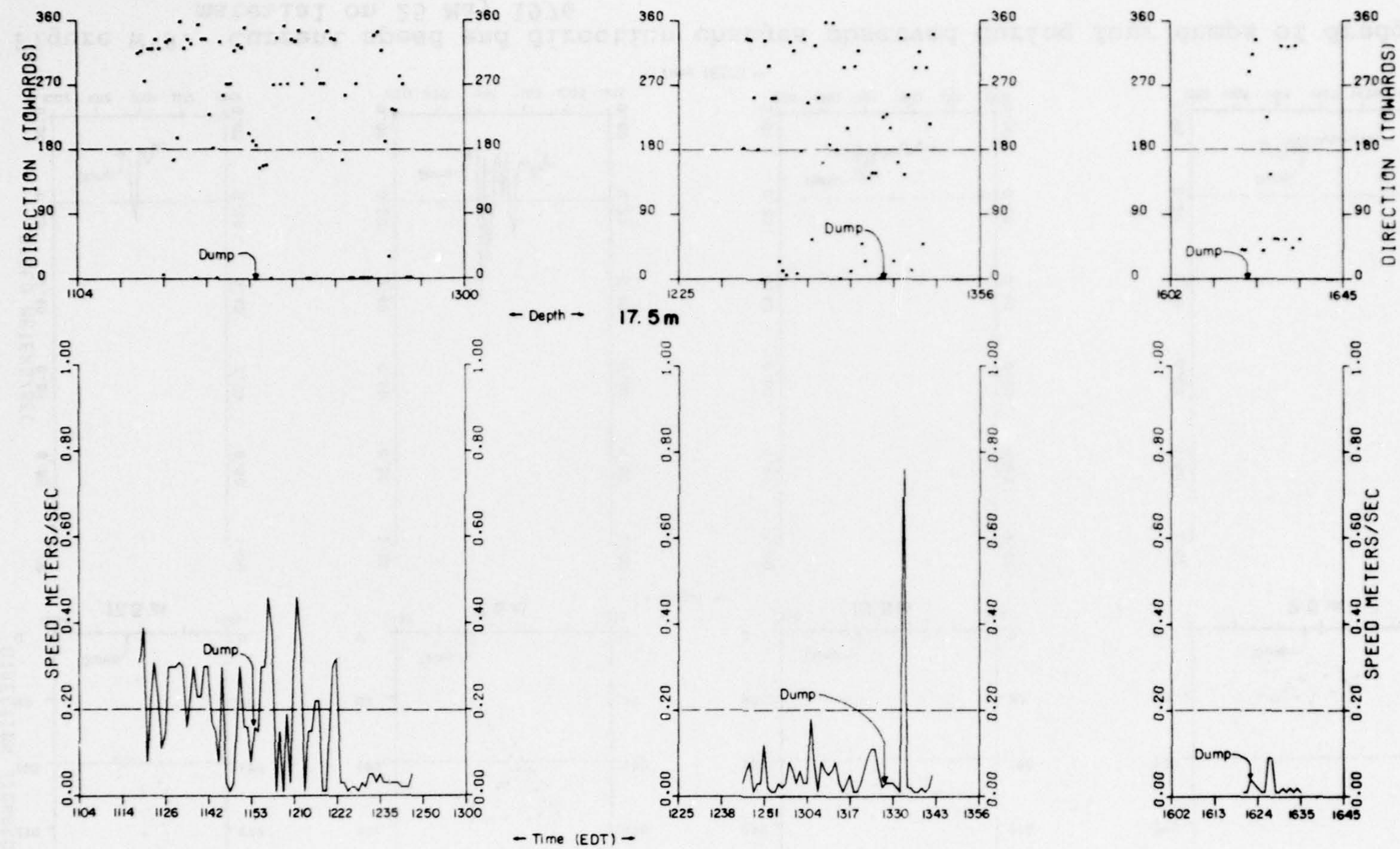


Figure W'7. Current speed and direction changes observed during three dumps on 24 May 1976

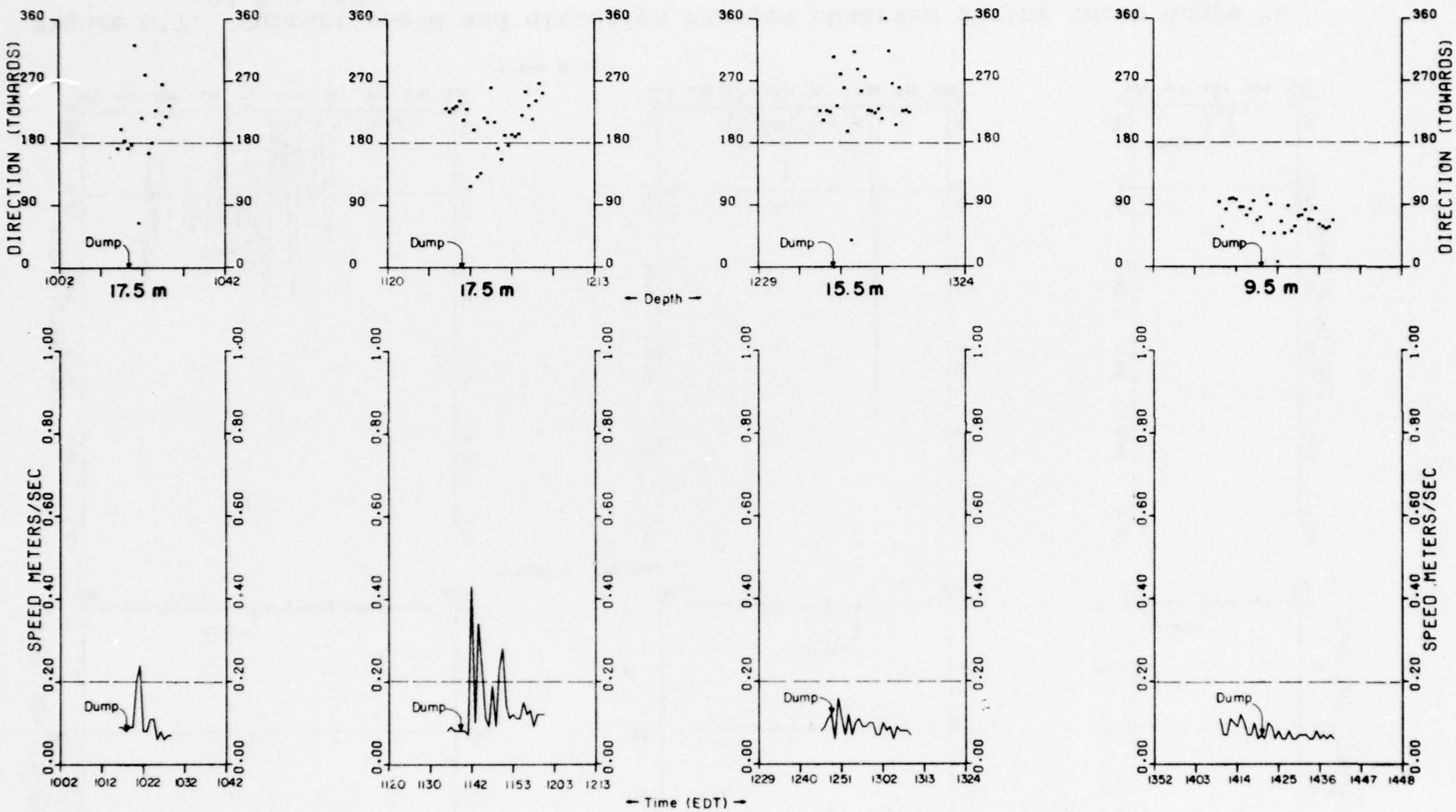


Figure W'8. Current speed and direction changes observed during four dumps of dredged material on 25 May 1976

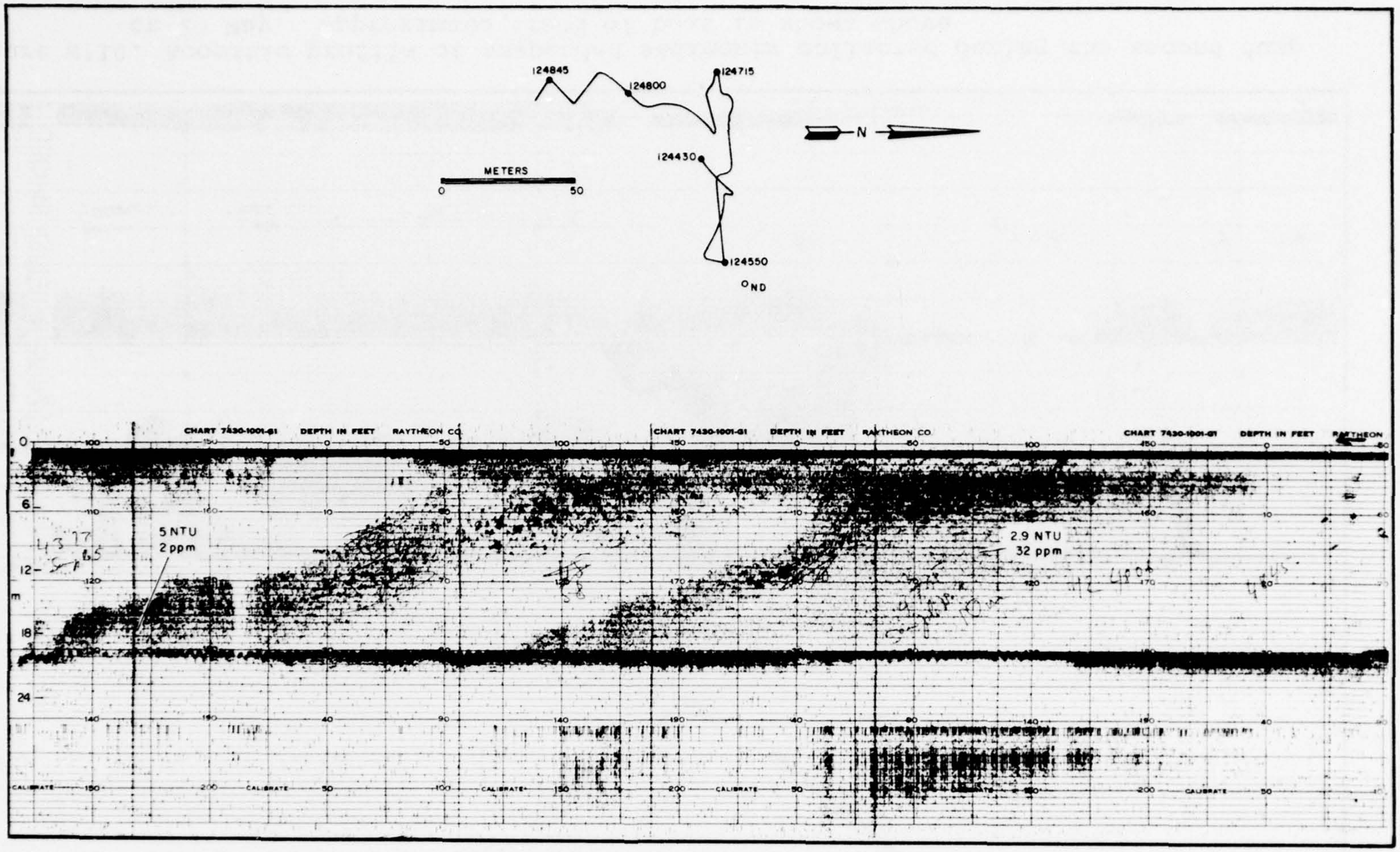


Figure W'9. Acoustic profile of suspended sediments collected during the third dump on 26 May. Approximate track of the boat is shown above (Ppm denotes suspended sediments and NTU are turbidity measurements)

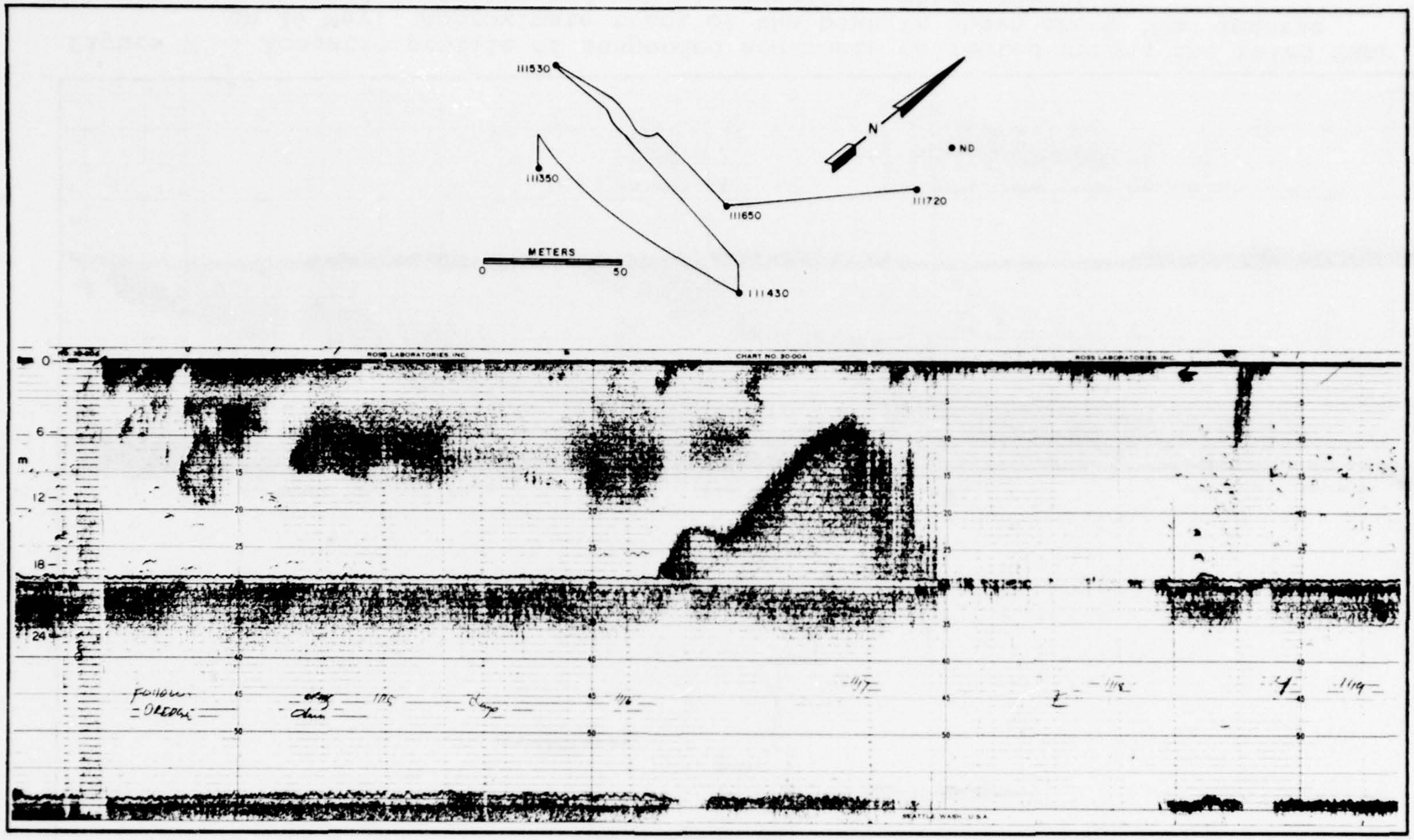


Figure W'10. Acoustic profile of suspended sediments collected during the second dump on 26 May. Approximate track of boat is shown above

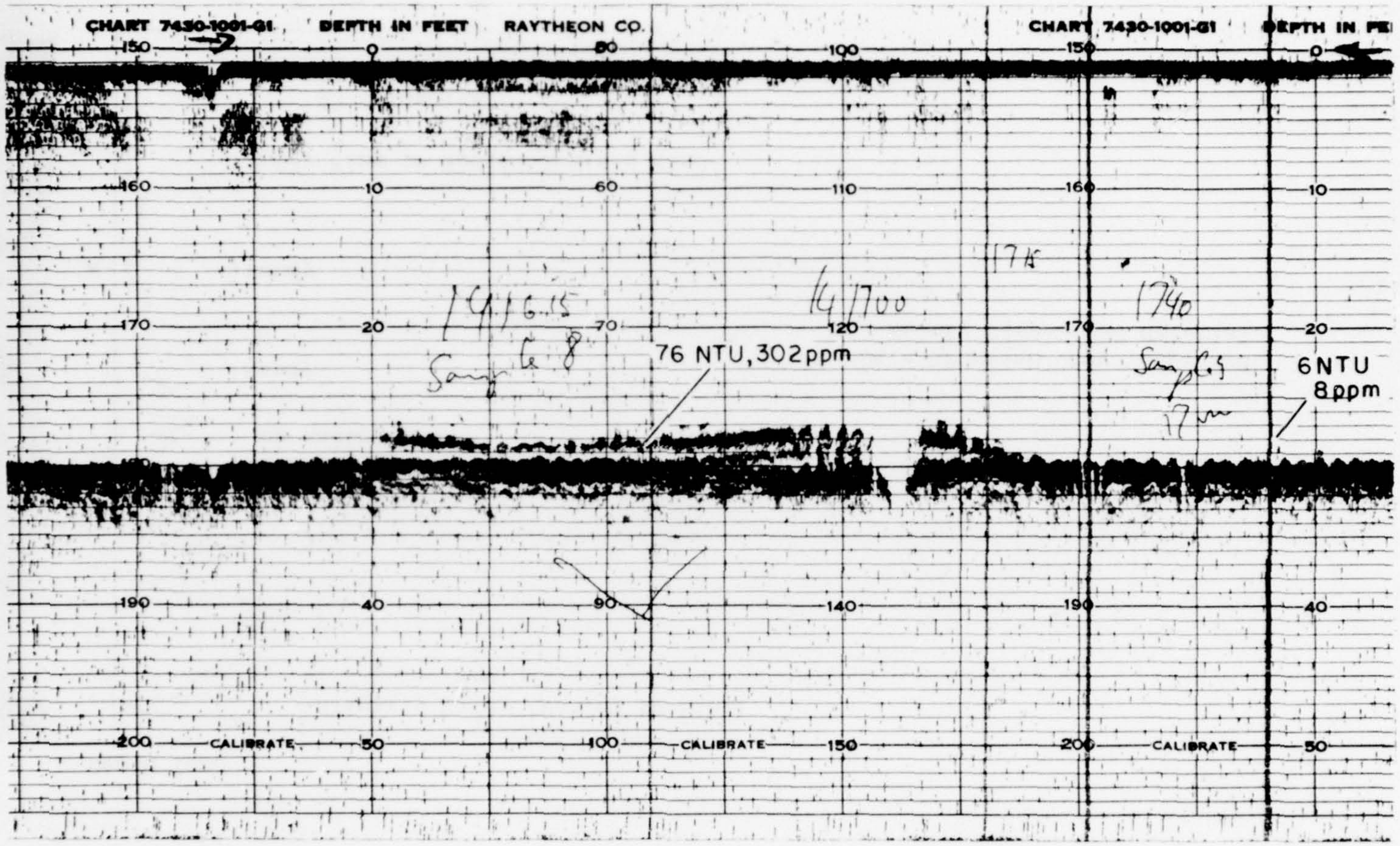


Figure W'11. Sitting plume of dredged material observed on the fourth discharge on 26 May 1976

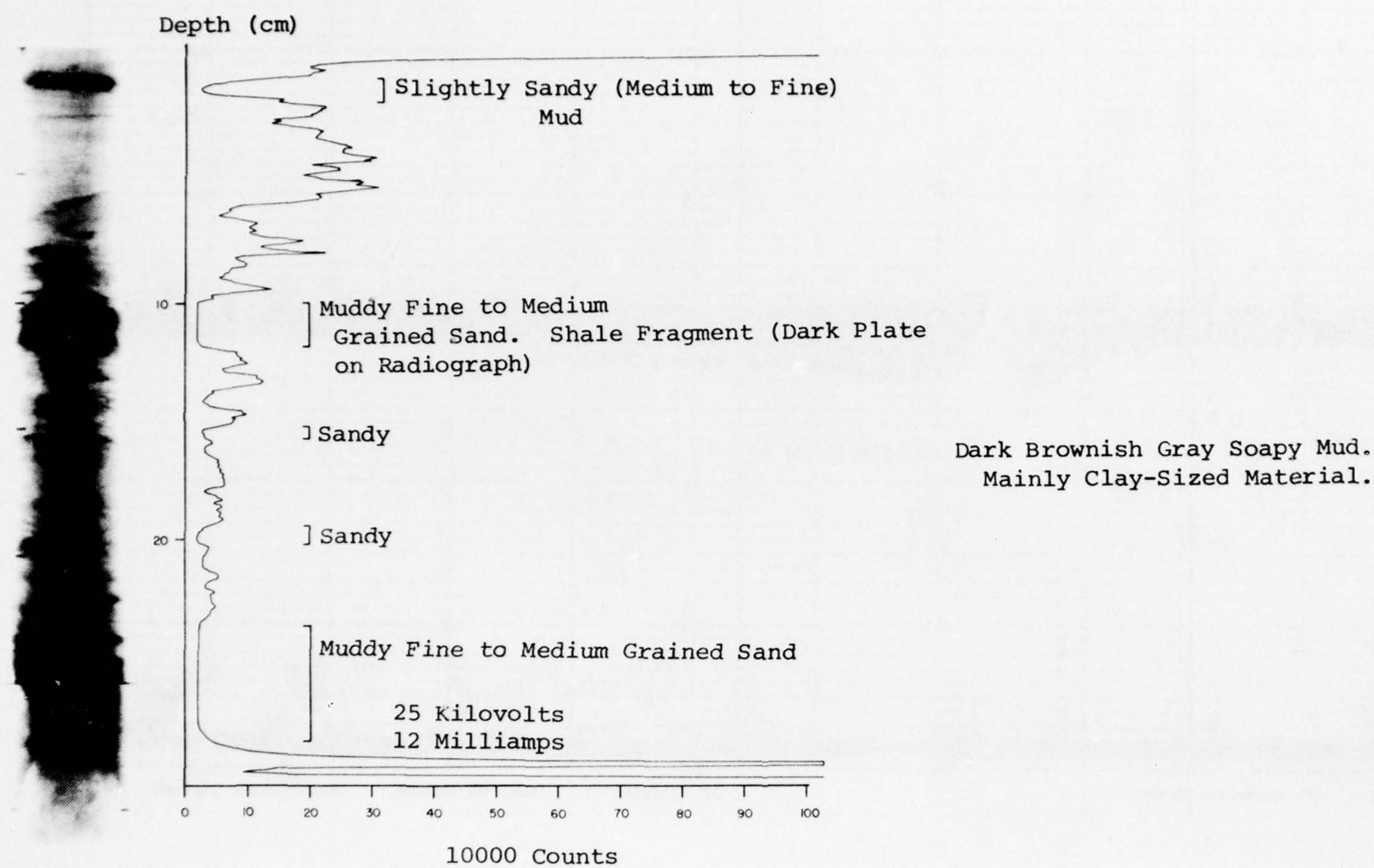
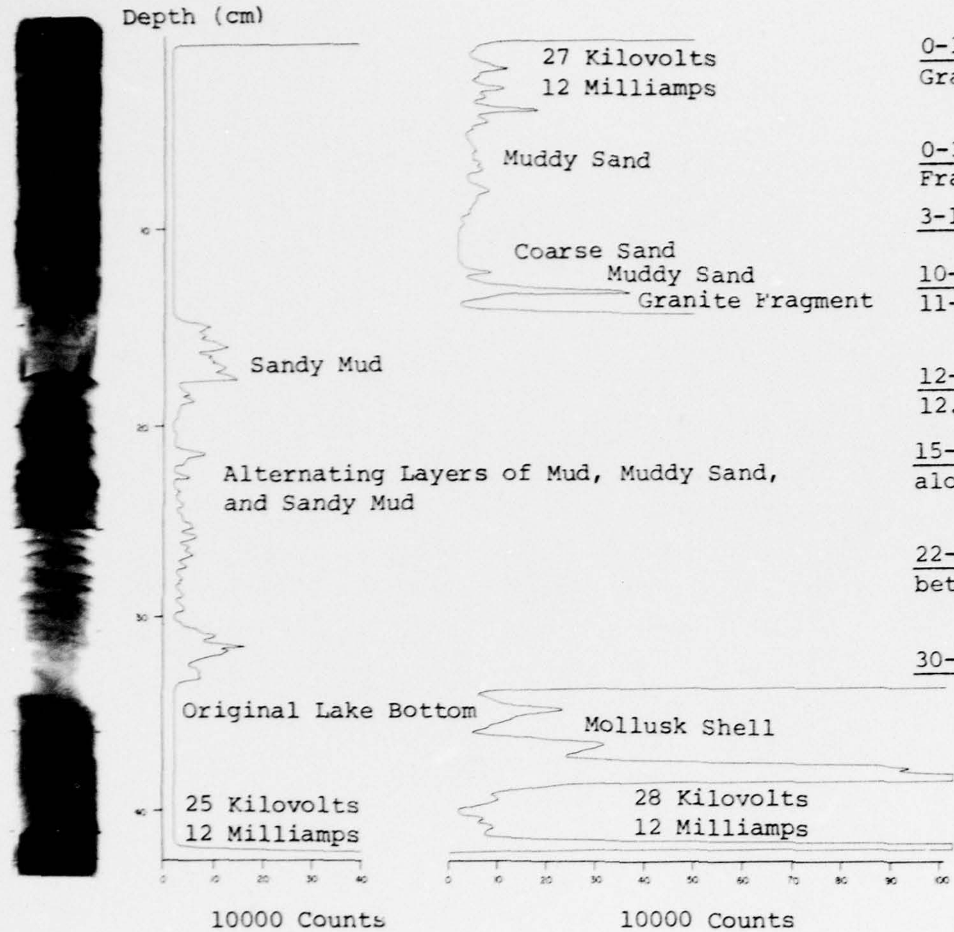


Figure W'12. Radiograph and X-ray scan of sediment core "M2" collected on 20 May 1976 (predisposal)



0-14 cm Predominantly Medium to Coarse Grained Sand with some Mud.

0-3 cm Muddy Sand with Leaves and Plant Fragments (stems, etc.).

3-10 cm Muddy Sand.

10-12 cm Coarse Tan Sand. Cinders at 11-12 cm.

12-14 cm Muddy Sand with Leaves at 12.5 cm.

15-18 cm Sandy Mud with Shale Fragments along Right Side of Radiograph.

22-30 cm Muddy Sand, Layers esp. between 25-30 cm.

30-33 cm Dark Gray Mud

33-42 cm Muddy Sand

Mud Generally Dark Gray, Sandy Layers Brown and Tan. Muds contain Fine Black Grains.

Figure W'13. Radiograph and X-ray scan of sediment core "T5" collected on 10 June 1976

In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Danek, L J

Aquatic disposal field investigations, Ashtabula River Disposal Site, Ohio; Appendix B: Investigation of the hydraulic regime and physical nature of bottom sedimentation / by L. J. Danek ... [et al.], Nalco Environmental Sciences, Northbrook, Illinois. Vicksburg, Miss. : U. S. Waterways Experiment Station; Springfield, Va. : available from National Technical Information Service, 1977.

xiii, 115, [446] p. : ill. ; 27 cm. (Technical report - U. S. Army Engineer Waterways Experiment Station ; D-77-42, Appendix B)

Prepared for Office, Chief of Engineers, U. S. Army, Washington, D. C., under Contract No. DACW39-75-C-0108 (DMRP Work Unit No. 1A08B)

Literature cited: p. 107-110.

1. Ashtabula River. 2. Bottom sediment. 3. Disposal areas. 4. Dredged material disposal. 5. Hydraulic regime. 6. Lake Erie. 7. Sedimentation. I. Nalco Environmental Sciences. II. United States. Army. Corps of Engineers. III. Series: United States. Waterways Experiment Station, Vicksburg, Miss. Technical report ; D-77-42, Appendix B.

TA7.W34 no.D-77-42 Appendix B